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NATIONAL MUSEUM OF VICTORIA MELBOURNE

THE ROYAL SOCIETY
OF
TASMANIA

PAPERS & PROCEEDINGS

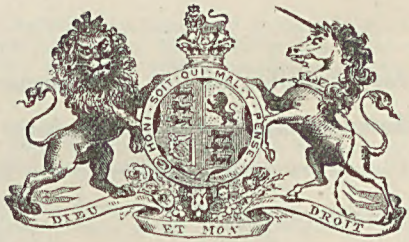
OF

THE ROYAL SOCIETY

OF TASMANIA

FOR THE YEAR

1925



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The responsibility of the statements and opinions in the following papers and discussions rests with the individual authors and speakers ; the Society merely places them on record.

THE ROYAL SOCIETY OF TASMANIA

The Royal Society of Tasmania was founded on the 14th October, 1843, by His Excellency Sir John Eardley Eardley Wilmot, Lieutenant Governor of Van Diemen's Land, as "The Botanical and Horticultural Society of Van Diemen's Land." The Botanical Gardens in the Queen's Domain, near Hobart, were shortly afterwards placed under its management, and a grant of £400 a year towards their maintenance was made by the Government. In 1844, His Excellency announced to the Society that Her Majesty the Queen had signified her consent to become its patron; and that its designation should thenceforward be "The Royal Society of Van Diemen's Land for Horticulture, Botany, and the Advancement of Science."

In 1848 the Society established the Tasmanian Museum; and in 1849 it commenced the publication of its "Papers and Proceedings."

In 1854 the Legislative Council of Tasmania by "The Royal Society Act" made provision for vesting the property of the Society in trustees, and for other matters connected with the management of its affairs.

In 1855 the name of the Colony was changed to Tasmania, and the Society then became "The Royal Society of Tasmania for Horticulture, Botany, and the Advancement of Science."

In 1860 a piece of ground at the corner of Argyle and Macquarie streets, Hobart, was given by the Crown to the Society as a site for a Museum, and a grant of £3,000 was made for the erection of a building. The Society contributed £1,800 towards the cost, and the new Museum was finished in 1862.

In 1885 the Society gave back to the Crown the Botanical Gardens and the Museum, which, with the collections of the Museum, were vested in a body of trustees, of whom six are chosen from the Society. In consideration of the services it had rendered in the promotion of science, and in the formation and management of the Museum and Gardens, the right was reserved to the Society to have exclusive possession of sufficient and convenient rooms in the Museum, for the safe custody of its Library, and for its meetings, and for all other purposes connected with it.

In 1911 the Parliament of Tasmania, by "The Royal Society Act, 1911," created the Society a body corporate by the name of "The Royal Society of Tasmania," with perpetual succession.

The object of the Society is declared by its Rules to be "the advancement of knowledge."

His Majesty the King is Patron of the Society; and His Excellency the Governor of Tasmania is President.

NATIONAL MUSEUM OF AUSTRALIA

THE ROYAL SOCIETY OF TASMANIA

PAPERS AND PROCEEDINGS, 1925

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PAPERS
OF
THE ROYAL SOCIETY OF TASMANIA
1925

NATIONAL MUSEUM MELBOURNE

TASMANIAN GIANT MARSUPIALS

By

H. H. Scott, Curator of Launceston Museum,

and

Clive E. Lord, F.L.S., Director of the Tasmanian Museum, Hobart.

(Read 9th March, 1925.)

In the years 1870 to 1884 Professor O. C. Marsh created a new Order for the reception of certain fossil mammalian remains, which he designated (Marsh, 1884) *Dinocerata*. This Order included the extinct creatures now called *Titanotherium robustum* and *Tinoceras ingens*, as well as others that need not here detain us. The sifting processes of modern taxonomy have necessitated the removal of the two creatures named, and their separation into distinct Sub-orders (of the Order *Ungulata*) namely:—

Sub-order *Titanotheriidæ*, of which *Titanotherium robustum* is typical, and Sub-order *Amblypoda*, which not only contains *Tinoceras ingens*, but also the European extinct ungulates known as *Coryphodon* and their American allies. Tentatively, *Arsinoitherium*, which is now removed to another Sub-order (*Embrithopoda*), also found a resting place here. Leaving out the last-named animal, it will be obvious that Marsh's Order of *Dinocerata* covered a wide area, and included within its circumference animals more or less Rhinoceros-like, and some, that while armed with fighting bosses, upon their skulls, did not closely simulate the make-up of a modern Rhinoceros. Strictly speaking, neither *Titanotherium*, which is the most Rhinoceros-like of the group, nor

Tinoceras ingens, which is nose armed with bony bosses, was a Rhinoceros in the modern sense of the term. Indeed, as far back as 1876 Professor R. Owen expressed (Owen, 1876) his doubts as to the nature of the nasal weapons with which the *Dinocerata* were armed, and suggested that the absence of vascular grooves from the bony bosses indicated that they did not simulate the horns of the Ruminants. Professor Marsh, in his Monograph upon the *Dinocerata* (Marsh, 1884, pp. 167-168), refers to this question, and suggests that hard pads of skin may have covered the bosses, or that even horns similar to those of the American Antelope may have been present, since in that animal (*Antilocapra*) the horn cores were smoother than those of the *Dinocerata*. This lengthy introduction is essential to a clear understanding of what we have said of the parallel evolution in Australia of Marsupials that were nasally armed. Such paralleled items chiefly relating to the modifications of the anterior part of the skeleton, as the Giant Marsupials evolved their fighting weapons. As these weapons, we think, were more like those of the modern perissodactylan Rhinoceroses than those of *Titanotherium* or *Tinoceras*, we used, as a vernacular name, for the nasally armed marsupials that of "Marsupial Rhinoceroses," a term that has apparently called out so much protest that it is worth while to review the actual evidence.

The first point to stress is *that vascular grooves exist in the areas of the skulls of the giant marsupials, which are without any great elevations, such as obtain in either Titanotherium or Tinoceras.*

Secondly, the areas covered by these fighting weapons in the *Nototheria* were of considerable size, suggesting some such weapon as that of a modern Rhinoceros, and one that was nourished from various parts of that basal area, and evolved out of the hairy dermal covering. That its base may have been transitional between true skin and agglutinated hair, and its upward extension directly derived from the hair, as in a modern Rhinoceros, seemed to us as likely as not; accordingly, we wrote in terms of that assumption. Upon the broad points of anatomy, a *Nototherium* was much nearer to *Tinoceras* than to *Titanotherium*, but all attempts at comparison between a giant marsupial and any of the *Dinocerata*, as Marsh called them, must end when we come to the feet, since the marsupial manus and pes stand unique.

Our publications on this subject have all been intended to show that any race of animals that begins to acquire

nasal armament will, more or less, follow the main lines set by the *Dinocerata* and the Rhinoceroses, since these practically cover the whole field of possibilities, and we have cited the several approaches and departures to and from the animals named as we noted them, regardless of man-made taxonomy. Further, the place which the *Nototheria* occupied in the faunal list of Australia was similar to that which the *Dinocerata* (to again use the widely covering term of Marsh) held in the American faunal list, and in habits they had as much in common as the Dasyures of Australia have with the Martens and Genets of other lands.

In the American Eocene Animals cited the acquisition of fighting weapons was gradual, as it was with the Australian Marsupial Nototheres, and we are busy trying to piece together the several sequences. As we stated (Scott and Lord, 1920, p. 76) in August, 1920, "A wonderful and most interesting group of marsupial animals has died out in our immediate zoological province, and as the remains available to us are superior in point of preservation to anything obtained in other parts of Australia, we are tempted to pay more attention to phyletic than to taxonomic data."

Recognising the need for considerable research with regard to this interesting group before many matters can be treated in detail, we have preferred to treat the subject in a general manner rather than to enter into details of classification, etc. To such criticism as the above course has brought forth we offer the following remarks:—

1. The *Nototheria* were arising out of a Teleocerine into a more perfectly armed state, and that arming was apparently being derived from skin and hair, rather than from true horn—itself an epidermal derivative.

2. The anterior parts of their skeletons were being changed to meet these progressive alterations, and we are at work upon all such data as the fossil remains come to us from our ancient lake beds.

3. We assumed that a nasally armed marsupial was better understood by the public generally in terms of the Greek designation Rhino-keras—or its accepted rendition, Rhinoceros—than it would have been had we turned it into Latin and named a Nototherium—A Nasocornuted Marsupial.

Museum Curators who have to meet inquiry from the leisurely dilettante, the specialist, and the man of the street, are apt to use terms that are self-descriptive. In our

case we were brought face to face with a new setting of an old problem in regard to Australian Marsupials, which in essence was as follows:—The teaching had been strongly instilled into the public mind that our Marsupials were a race of non-combative creatures, and that even the extinct giants were perfectly harmless animals. The voice of the one old Prophet who had chanted to the opposite tune had been drowned by the opposition's clamour. When we found that the titanic marsupials that came our way were (to use our much abused term) starting a "fighting trend," and even manifesting stages of advancement thereon, we said so—and used such terms as we considered best illustrated the facts. The average man when told, as our Museum cards do tell, that these marsupials were more or less Rhinoceroses in the making—and when he sees for himself that the heavier the nasal weapon the more the skeleton is altered to meet the new conditions—is able to get some sort of a mental picture to work upon, and he is not likely to bother if the selected name be a marsupial-like Rhinoceros, or a nose-horned marsupial.

We would remind the critics of our vernacular designations that they have overlooked one salient fact, namely, that the pacific or aggressive nature of the larger marsupials was the item awaiting solution at the time we started, and not any one—or all—minor details of classification. The latter can be settled once and for all, when we know the animals by complete skeletons, and not by deductions made from skeletons slowly and painfully put together from scattered and quite unserial bones and teeth.

The small amount that we have been able to do has been enough to show us how great is the unknown, and so we assume that the sun has not yet risen upon the day of taxonomic minutiæ, and we are acting accordingly.

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1876 Owen, R. On the existence or not of horns in the Dinocerata. Amr. Jour. Science & Act., Vol. XI., pp. 401-403, 1876.

1920 Scott and Lord. Studies in Tasmanian Mammals, living and extinct. Proc. Roy. Soc. Tas., August, 1920, page 76.

SOME NOTES UPON A TASMANIAN ABORIGINAL SKULL.

By

H. H. Scott, Curator of the Launceston Museum,

and

R. McClinton, D.D.S. (Cal.).

Plates I.-VIII.

(Read 9th March, 1925.)

The Skull, which has recently come to light, was discovered upon the North-East Coast, and apparently represents the total "find," since extended search failed to add other remains.

It is devoid of a mandible, but otherwise is extremely perfect, even the turbinoid bones being *in situ*—it is that of a young female.

GENERAL DESCRIPTION OF THE SKULL.

All the characteristics of the Tasmanian skull are in evidence, the age being certified to by the non-erupted wisdom teeth, and the following items of osteology:—

1. There is a trace of the frontal suture at the nason, and some evidence of it higher up as the frontal recedes to the bregma.

2. The pre-maxillo-maxillary suture is not ankylosed.

3. The occipito-sphenoidal suture is still spongy, complete ankylosis not having taken place.

In this latter connection it may be said that of three other female skulls of the same race, available to us for study, two show the suture open, with non-erupted wisdom teeth, and one shows the suture ankylosed to extinction with the wisdom teeth still in their follicles. A male skull, in which the left wisdom tooth had alone been erupted, manifested a completely ankylosed occipito-sphenoidal suture. The female skull cited, with the closed suture and non-erupted teeth, is a larger and heavier cranium than the one that

forms the subject of our paper, but is beyond all doubt that of a female, being in point of fact No. 26 of Prof. R. J. A. Berry's Atlas.

In our skull under review we find the inion slightly developed, but rather less so than obtains in the other female skulls used for comparison. It seems reasonable to suppose that the protrusion of the skull in this region was both an age and a sex character. Upon the right side there is a parieto-squamosal ossicle 25 mm. long; it is quite loose. No epipteric appears upon this side, although one is present upon the left.

The most striking instance of wormian ossicles found in this skull is that of a divided "Inca bone," the two moieties of which are similar in outline, their shape being cordate. There is an ossicle upon the right side of the skull, situated in the Lambdoidal, slightly below the last parietal contribution to that suture. This is not exactly duplicated upon the left side, but rather higher up, the parietal thrusts a bony dart into the occipital. Again, upon the right side an ossicle occupies the squamosal notch. Upon this side, therefore, there are three ossicles directly relating to the squamosal ("temporal") element. The most interesting of the eight old ossific centres, active in this skull, has yet to be called attention to, namely, one found in the right orbit. This is a minute island of bone in the osplanum, slightly anterior to its junction with the sphenoid, in short, the so-called "orbital process of the sphenoidal turbinate "bone," known at times to appear in the skulls of lowly races. Osteologically, we are here dealing with a last relic of the external plate of the old pre-frontal. The styloid processes were not ankylosed to their respective bases (the tympano-hyals), and may not have even been ossified, but in any case they are missing, and the squamosal piers manifest the condition of articulation by syndesmosis with the stylo-hyals. Such conditions point to immaturity.

THE TEETH.

The palate of this truly primitive human being is a perfect horse-shoe shaped cavity, and the lingual aspect of the tooth line slightly widens as it goes backward, and is thus in marked contrast to that which obtains in the higher ape—*Troglodytes gorilla*—in which the tooth line is absolutely straight in antero-posterior extension. This posterior extension of the palate is in direct relation to the added width

of the face, and, all things being even, should not strongly alter the points of contact of the several teeth as the evolution of the human race proceeded. The Dentist of to-day, however, finds that the blending of races by intermarriage and the inherited effects of disuse, have both changed the character of the palate and altered the dental points of contact—essentially for the worse! In these circumstances a primitive skull, such as that before us, is of great value as an indication of the racial base line upon which modern complex conditions have been reared. In the gorilla the points of contact of the five cheek teeth are practically *central* and *even*, but in the primitive human the widening out of the palate rolled these points slightly to the labial aspect, the pivot point being the posterior surface of the last pre-molar. It seems reasonable to suppose that degeneration of the human palatal conditions would tend to reverse this outward thrust, and that, as a natural result, the present-day contracted and distorted palate would follow. In a word, the complex man of to-day—the sum total of all antecedent individuals—reverts to a period of racial history in which he first began to make human history, as such, and departed from the anthropoid apes in his long upward climb. An examination of the second molars of this skull shows that the lingual cusps are higher and more worn than the labial ones, which is exactly what might be expected if the outward thrust of the tooth line was more strongly marked at the alveolar line than it was at the floor of the palate. Put in another way, the maxillary walls of the palate bent outwards at a more rapid rate than the maxillary moieties, that constituted the floor of the palate, increased in width. The reversion of one, or both, of these osteological changes, together with characters later acquired through alterations of diet, are the potent factors in abnormal human dentition to-day. In conclusion, it may be said that "Cobia," the lowest and most debased of Tasmanian Natives, has a palate that makes a nearer approach to that of the gorilla than any other Native's skull available to us for study.

THE ORAL CAVITY.

The oral cavity is large, with a well-formed round arch; the vault is ample, but nearly flat. All the bony elements that enter into the formation of the cavity are regular in outline and well defined. The articular sutures are clearly marked. In the median suture, distad of the interproximal space of the central incisor, lies the anterior palatine for-

amen, a single, large aperture, and, therefore, in contradistinction to the conditions that obtain in skulls of the higher races, where it usually appears as a group of four foramina. Immediately behind this foramen is the suture of the incisive bone—which pre-maxillary suture extends across the junction of the maxo-maxillary for about 5 mm. upon either side. The maxillo-palatine suture is to be noted in the item of its left branch leaving the central line 4 mm. earlier than the right moiety. The posterior palatine canals are large, and occupy a position approximately centrad of the last-named suture. Several accessory palatine foramina exist behind them. The general surface of the maxillary is rough, and penetrated by a number of minor foramina; also, here and there, the outer table of the bone is raised into projecting points and ridges. The most marked instances of the latter are to be found near the maxillo-palatine suture, just in line with the posterior palatine canals. Externally, the maxillary bone conforms to the outline of the arch, its surface being alternately grooved and ridged in a vertical direction, thus indicating the rooting of the six anterior teeth and the two pre-molars. We note also that here, as within the arch, numerous foramina penetrate the alveolar rims. Several nutrient foramina are also to be found upon the facial portion of the maxillary, centrad of its junction with the malar. Reverting to the palatine areas again, we may note that the right internal pterogoid plate ends in a well-marked hamular process; mutilation has unfortunately robbed the skull in this respect upon the left side.

TEETH.

The skull is abnormal in having 17 teeth *in situ*, 14 being those duly erupted during life, and the remainder are in their respective dental follicles. The third pair of molars were upon the eve of eruption, the over-lying bone having been fully absorbed. The abnormal molar, which is situated upon the left side about half-way up the zygomatic surface of the maxillary, is apparently imperfectly calcified, its surface is soft and crenated. With the exception of the two central incisors, which are slightly rotated towards the median line, all the teeth present a beautiful curve, the individual teeth taking their places with unerring accuracy, and with perfection as to points of contact. The incisors, which taper in outline, have broad cutting edges—sides that taper to a small rounded neck; the mesial sides mark

TASMANIAN ABORIGINAL.

The Skull in *Norma lateralis.*

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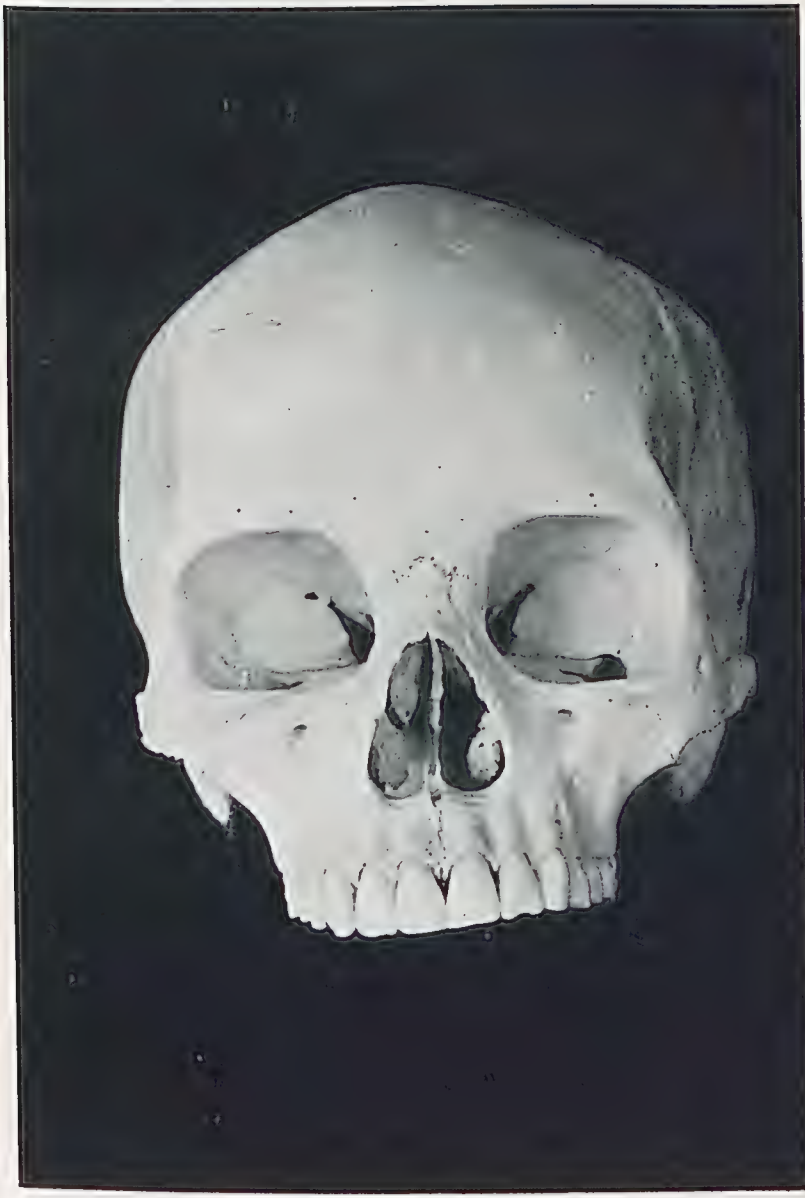

TASMANIAN ABORIGINAL.

The Skull in *Norma facialis*.

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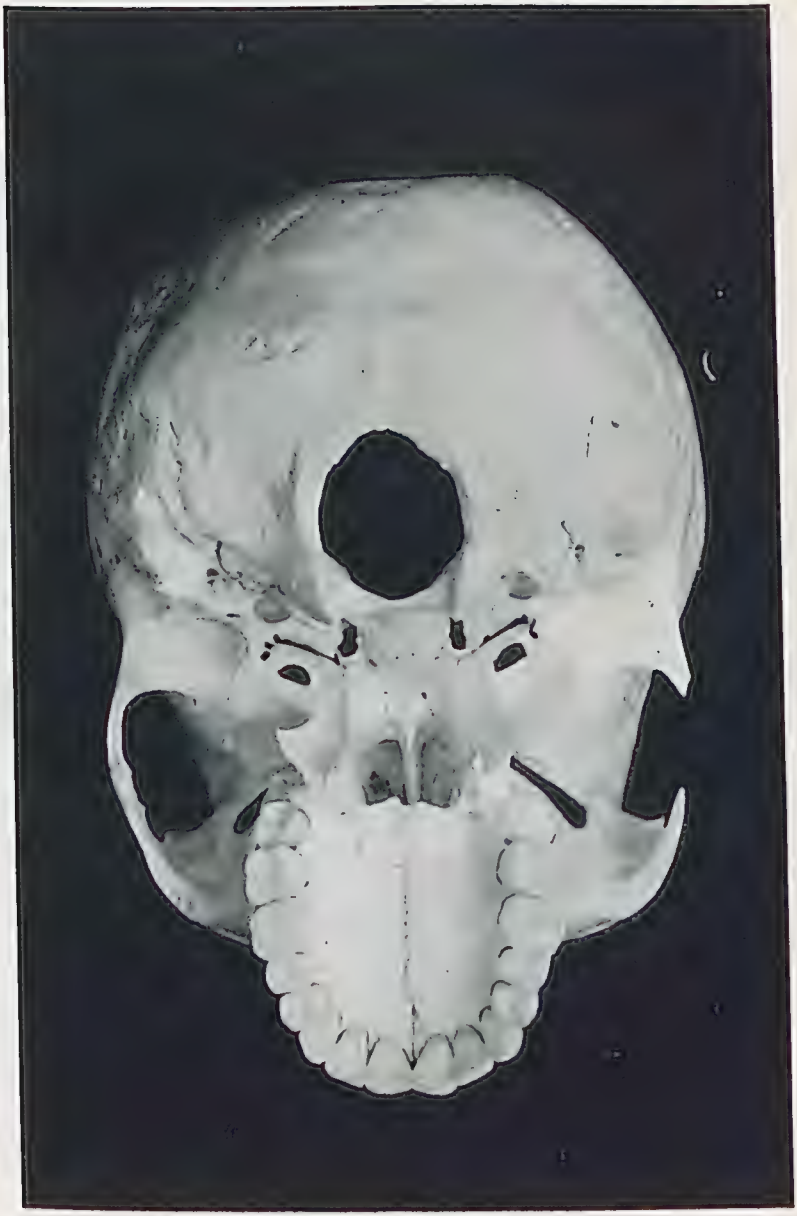

TASMANIAN ABORIGINAL.
The Skull in *Norma basalis.*

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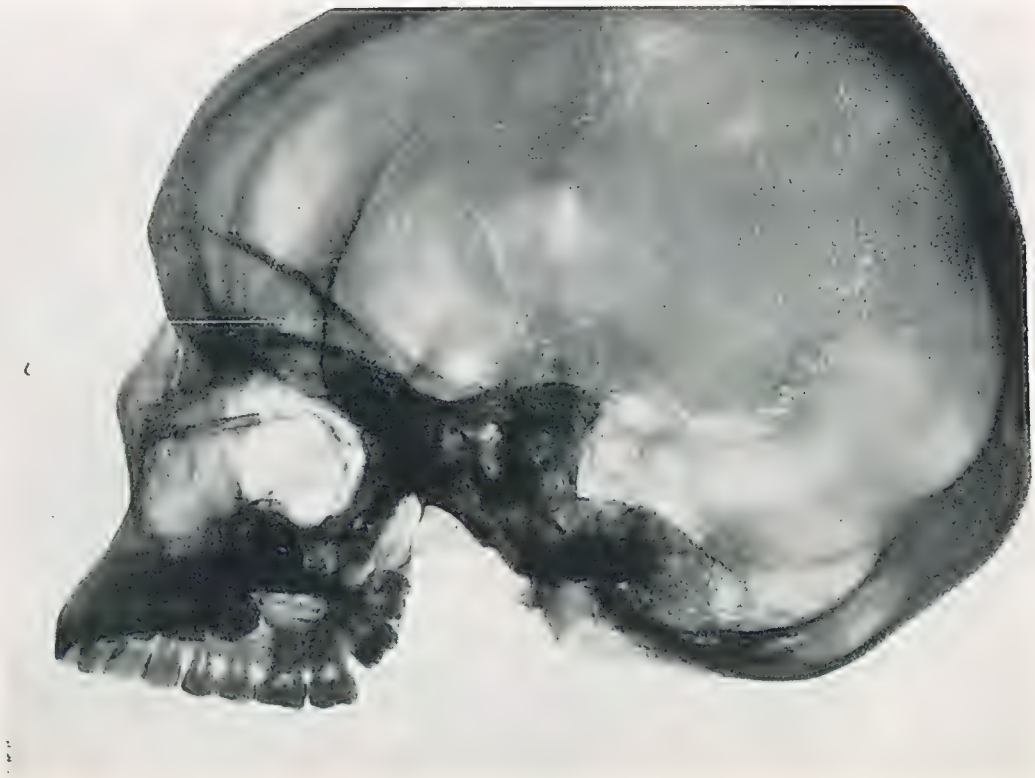


TASMANIAN ABORIGINAL.

Skiograph of the Skull in *Norma lateralis.*

ARCHIVES OF THE JEWISH THEOLOGICAL SEMINARY

TASMANIAN ABORIGINAL.

Skiograph of the Skull in *Norma basalis*. (Complete view.)

NATIONAL ARCHIVES FILM MICROFILM

TASMANIAN ABORIGINAL.

Skiograph of Palate and Teeth. (Viewed in *Norma basalis.*)

NATL. MUSEUM, MELBOURNE

the sharpest angle with the plane of occlusion. Upon both incisors and pre-molars the developmental marks may still be traced, although the effects of action upon coarse food have started to become manifest. Upon the left hand side of the arch, with the mesial angle of the left central incisor as a starting point, the plane of occlusion bears away from the normal about 5 degrees in a graceful curve, and does not become normal again until we reach the second pre-molar—effects incidental to excessive chewing upon this side. The lateral incisor shows a deep indentation upon its cutting edge. The lingual surfaces of all the teeth are highly polished as the natural result of correct usage. The pre-molars and the first molars upon both sides show the effects of attrition, but the second molars (although well polished) only show wear upon the lingual cusps. With the exception of the abnormal fourth molar, all the teeth are physically perfect, and without structural defects such as commonly obtain among the white races of to-day. The radiographs show large pulp canals in all the teeth, and an absence of bone absorption; in a general way, these data indicate youth. The rooting of the teeth is as follows:—Incisors single rooted, pre-molars double rooted, first molars triple rooted, while the roots of the second molars are drawn to a point. This latter is to be regarded as a special provision of nature to allow of the mutual adjustment of the occlural surface to conform to the curve of occlusion, and thus assist the act of food mastication. The gingival surfaces are all healthy, and devoid of any pathological conditions such as follow upon the ravages of pyorrhœa. In conclusion, it may be stressed that the vigorous jaw action incidental to the grinding of coarse food called out such a rich supply of blood as to fully nourish the teeth, and much of their perfect condition may be directly traced to this important factor.

After the above notes had been written Dr. William K. Gregory's work upon the Origin and Evolution of Human Dentition became available to us, and we notice that upon page 421 he figures (after Keith) a Tasmanian palatal arch, and compares it with that of a Mousterian Youth and certain primitive apes. As our photographs will show, the arch we are dealing with is much nearer to that of the Mousterian than it is to the Tasmanian outline he re-produces. In this connection we also desire to record the fact that four female and six male skulls available to us all *agree in having palatal arches of this type*, but that an eleventh skull (that of

"Cobia"), as we have already stated, is more gorilla-like, and in a general way conforms to the figure by Keith. We also call attention to the note upon page 478 of Dr. Gregory's work respecting "shovel shaped" incisors, and invite attention to the shape of the incisors shown in the skull we have under study; their extreme perfection should supply useful data for future workers in this field of research.

EXPLANATION OF PLATES.

Plates I.-VIII.

1. The skull viewed in *Norma lateralis.*

2. *Norma Facialis.*

3. *Norma occipitalis.*

4. *Norma basalis.*

5. Skiograph of *Norma lateralis.*

6. Skiograph of *Norma facialis.*

7. Skiograph of *Norma basalis.*—Total outline, with internal structures.

8. Skiograph of *Norma basalis.* Teeth and palate only.

All Photos by Dr. R. McClinton.

NATIONAL MUSEUM MELBOURNE

ON THE OCCURRENCE OF *WOLFFIA ARRHIZA*, *WIMM.*, IN TASMANIA.

By

L. Rodway, C.M.G., Government Botanist.

(With 5 Figures.)

(Read 15th April, 1925.)

Marsh plants have generally the widest distribution, and of the Duckweeds these are no exceptions. *Lemna minor*, *L.*, and *Lemna trisulca*, *L.*, both cosmopolitan species, are the only plants of this family that have hitherto been recorded from Tasmania. We now may report *Wolffia*.

Growing in a marsh near Lewisham, also on Maria Island.

The species of *Lemna* float horizontally on the surface of the water, or if quite submerged, which often occurs with our plants of *L. trisulca*, their position is still horizontal. Each plantlet sends a single rootlet from the centre of its under-surface; in one species, not Tasmanian, more than one of these slender rootlets develop, while the rootlet is often absent from fronds of *L. trisulca*. Another feature of this genus to which we may refer is the fact that the plants are bisexual; the flowers are very rare, and arise from the edge of the frond, and mostly consist of two stamens and one carpel. Propagation takes place by lateral budding.

The genus *Wolffia* is of quite a different structure. Instead of floating horizontally, it does so perpendicularly, exposing an edge to the air and sinking the greater portion of the frond as an oblique plate. Flowering is unisexual, and takes place in the centre of the exposed portion. It bears no root.

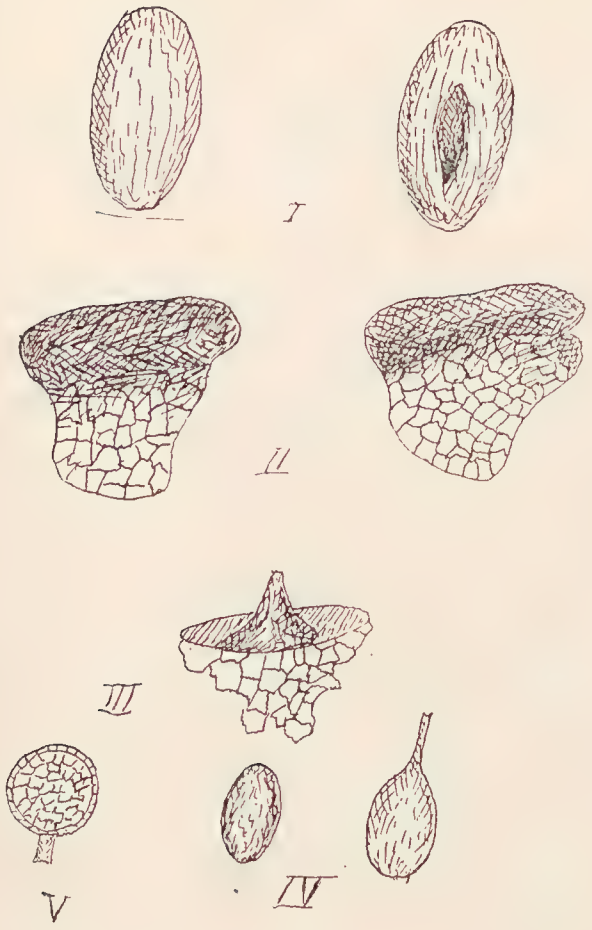
The following is a description of *Wolffia arrhiza* as found in Tasmania:—

In surface view the exposed portion of the frond is oblong, convex, 1 mm. long by 0.5 mm. diameter, green, cells small. In perpendicular aspect the frond extends below into

an oblique colourless process, the epidermal cells large and the inner ones smaller, but all colourless; the green portion forming a disc about 0.3 mm. thick. Propagation takes place by budding on the concave edge.

When a frond proceeds to flower a fossa forms in the centre of the green surface, and at the base of this fossa, whether staminate or pistillate, the flower forms. The male flower consists of a single stamen, 130μ. diameter, white, globular, unilocular, the wall of which is formed of a single layer of muriform cells. Pollen grains spherical, minutely echinulate, 16μ. diameter. The stamen is borne on a short filament; it protrudes from the fossa at maturity. The wall soon disintegrates, and the dry pollen drifts away on the surface of the water in quest of a projecting stigma.

The female flower consists of a single flask-shaped carpel, elongated above into a short style, ending in an irregular stigma, altogether about 250μ. long. The carpel contains a single erect orthotropous ovule. After fertilisation the ovule becomes slightly enlarged and indurated, the ovarian walls shrivel up, but the seed usually remains in the fossa. The whole plant sinks to the bottom and rests in the mud.



EXPLANATION OF FIGURE.

Fig. I. Upper view of sterile and fertile fronds.
Fig. II. Lateral view.
Fig. III. Seed condition.
Fig. IV. Carpel and ovule.
Fig. V. Stamen in section.
Variously magnified.

THE R. M. JOHNSTON MEMORIAL LECTURE, 1925. THE MAMMALIAN TOILET AND SOME CONSIDERATIONS ARISING FROM IT.

By

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With 23 Text Figures.

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Few ways of honouring a departed pioneer in science could be conceived as more appropriate than the establishment of a memorial lecture. Among the memorial lectures that have been founded the world over to commemorate the life and work of outstanding men in the realm of Science, the R. M. Johnston Memorial Lecture may be considered as a younger member. For this very reason the delivery of the lecture becomes a matter for careful deliberation. Should the lecturer attempt to interpret some phase of the work of the pioneer in whose honour the lecture is delivered? Should he take some episode from the career of the leader and elaborate that into a theme into which his own work may be woven? Or should he merely give his own and, as far as his ability lies, the best of his own, as a tribute to the memory of the man whose life work the lecture honours?

I am tempted to adopt this last course, and this for two reasons; the one that certain memorial lectureships have an accepted standard, to which successive lecturers, over the interval of centuries, have attempted to attain, of expounding the doctrines of some great teacher.

It has often seemed to me that in these lectures there was a possibility that the lecturer might have had a message to deliver, but that in paying tribute to the master and attempting some familiarity with his writings and his work the message has become so subordinated as to be well nigh undecipherable.

The second reason for departing from the tradition that clings to certain memorial lectureships and, thereby, in establishing a precedent in this one, is that my predecessor

in this office, Professor Sir Edgeworth David, delivered what might be termed *the* R. M. Johnston Memorial Lecture.

There is no man who might be better trusted to place an appropriate verbal wreath upon the tomb of a scientific pioneer; no man who could better strew the pathway of memory with the petals of well merited praise than Sir Edgeworth David. It might be said that, as a memorial lecture, he has left this office a barren one by virtue of his own tribute.

I feel, therefore, that I am absolved from attempting a task such as Sir Edgeworth David accomplished. But I feel also that Sir Edgeworth's tribute is only one aspect of a memorial lecture; the other is to offer up, in memory of a great man, that which in one's present occupation seems most fitted to constitute a subject for philosophical reflection and for possible suggestion as to future lines of research. I shall, therefore, elect, as the R. M. Johnston Memorial Lecturer for 1925, to pay my homage rather in the form of a lecture which introduces certain matters for homely consideration than in attempting to elucidate any phase of work, or in dwelling upon any special researches, of the man whom we are met to honour.

Who first invented proverbs I do not know. There is a suggestion of the East about many of them, but probably they are common to all humanity. Most proverbs are retained in common usage since they may be employed as maxims wherewith age and experience may advise or admonish youth and inexperience. But some are double-edged. The child who is reproved for adopting the natural method of eating with his fingers has always in the background, even if it comes no further into usage as a very present help in time of trouble, the saying that "Fingers "were made before forks." The child is in the right. It is true, fingers *were* made before forks, and herein lies the charm that captivated Samuel Butler.

Butler's was the mind that placed forks and fingers in their proper perspective. What is a fork but a finger made, as we say, artificially? What is a fork but an extended organ —an external organ? Did we not make both? As Butler himself said (1): "The organs external to the body, and "those internal to it are, the second as much as the first, "things which we have made for our own convenience, and

(1) *Evolution, Old and New*, Reprint, Fifield, 1911, p. 39.

"with a prevision that we shall have need of them; the main "difference between the manufacture of these two classes of "organs being that we have made the one kind so often that "we can no longer follow the processes whereby we make "them, while the others are new things which we must make "introspectively or not at all, and which are not yet so incor-"porate with our vitality as that we should think they grow "instead of being manufactured. The manufacture of the tool "and the manufacture of the living organ prove, therefore, to "be but two species of the same genus, which, though widely "differentiated, have descended, as it were, from one common "filament of desire and inventive faculty."

Tools and limbs—there is not much between them. The limbs are part of us, and made in our own making; the tools are only temporarily part of us, and made independently of our structural unfolding. Forks and fingers; if we regard them as Butler did, there is not a great difference between them. Fingers grow on us, forks are part of us only during meal times; but we shall see that there is a very pretty sequence in the development of these things.

Fingers were made before forks, that is true. But think of how many things were made before fingers were invented, and, in order to limit the discussion, think of how many other things were made in order to assist and extend the office of the fingers in some very humble processes—functions which we are usually prepared to forget or to pass over.

Most people have a proper respect for the scientific worker whose daily occupation leads him to contemplate the ordering of the movements of the heavenly bodies, and even the man who spends laborious days in unravelling the story of atoms is recognised as one living in an elevated sphere of mentality. But what can be said for the man who has a mind of such a homely type that he is willing to be perplexed by the problem of how animals keep their ears clean? The process of keeping the ears clean is one that is generally considered to be hardly worth studying, and certainly one of which the importance does not excuse the nastiness. The business of keeping the ears clean is, however, only a detail in a great scheme of processes, some of the other details of which are far less suitable for polite discussion.

The whole great assemblage of processes we may group together under the title of Toilet Operations. These little operations are homely enough things, and yet if we are pre-

pared to forget their lowliness, and what might even be termed their unpleasantness, there are several lessons to be learned from them. Just as fingers were made before forks, so were fingers made before tooth brushes and tooth picks. But what preceded fingers in those animals in which the digits are so altered as to be useless for these functions? We shall see that, in almost all toilet operations, nature has invented some peculiar device for the performance of the function; that this device is rudimentary or absent when the animal possesses fingers, which can perform the operation better; and that, as a final stage, man has invented other artificial members to replace the use of the fingers. The sequence is in three stages. First there is the local mechanism, then there is the digit, and last the external instrument. Ears must be kept clean—every schoolboy knows it. In many animals there are structural specialisations developed for this purpose. There are processes of the external ear developed for shutting up the passage. There are, in many marsupials, for instance, mechanisms for folding the whole ear and protecting the inner parts; and then there are all sorts of specialised glands and specially directed hairs for keeping the passsage free from foreign bodies. In us some of these things persist. We have a complete system of wax glands, and secretor-motor nerves supplying them; we have rather variably developed specialised bristle hairs (vibrissæ) in the external auditory meatus. The wax that is secreted from the wax glands is a peculiar substance, its function seems obviously to be that of snaring particles of foreign matter gaining access to the external auditory meatus. It is a substance that does not decompose; but it slowly shrinks and dries after it is excreted. It seems as though in our ears wax were secreted at the bottom of the external auditory meatus, that it was destined to dry up, but that there was no normal mechanism for expelling it from the external auditory meatus. Indeed, we know that aural surgeons who are specially gifted in curing deafness are commonly especially skilled in the simple business of removing wax from the ear. But many years ago I was told by an aural surgeon that there was a mechanism provided for ridding the human ear of the wax that has been secreted and has accomplished its purpose. The wax, as it is secreted, enmeshes the vibrissæ, the axis of which is oblique. As it contracts it pulls these bristles down; but the turning point comes, the inspissated wax parts company with the surface of the

passage, the hairs straighten themselves suddenly, and the mass is loosened and freed. How true this dictum is I do not know, but that wax may be suddenly loosened from the ear, with a quite recognisable "click," is probably within the experience of all. I imagine that the explanation is a reasonable one, and I think that an inquiry along these lines might solve the problem of why some people are for ever becoming deaf, owing to the accumulation of wax, and others never suffer from this condition.

Whatever may be the mechanism of freeing the wax from the depths of the ear, there is no doubt that its ultimate removal is, in man, effected by the nail of the little finger. So obvious is the office of the little finger in this connection that for centuries the fifth digit of the manus was known to the learned by the name *Auricularis*. To-day we term it *Minimus*, but to my mind, though this name may be considered more polite, it lacks the distinction of assigning a definite function, however humble, to this digit.

In this matter of digital nomenclature we may take Diemerbroeck as our guide. Of the digits he says:—"The "first, which is the thickest, and equals all the rest for "strength, is call'd *Pollex* or the Thumb. The second is the "Forefinger from the use, call'd the *Index*, or *Demonstrator*, "the Pointer, because it is us'd in the demonstration of things. "The Third or *Middle*-finger is call'd *Impudicus*, *Famosus*, "and *Obscoenus*, the Obscene and Infamous, because it is "usually held forth at men pointed at for Infamy, and in "derision. The Fourth, the *Ring-finger*, or *Annularis* and "*Medicus*, the Physitian's-finger; because that Persons for-"merly admitted Doctors of Physic were wont to wear a "Gold Ring upon that Finger. The Fifth, call'd the Little-"finger, in Latin *Auricularis*, or the Ear-finger, for that "men generally pick their Ears with it." (2)

It may perhaps be doubted if this explanation of the name "obscoenus" for the third digit is correct. We all know of the degradation that results from being pointed at with the Finger of Scorn; but I have a fancy that this is not the origin of that very peculiar name for the middle, or longest, digit of the manus. As for Auricularis, he is clear and direct. There is no gainsaying Diemerbroeck's explanation of the name.

(2) Isbrand de Diemerbroeck, *The Anatomy of Human Bodies*. Translated by William Salmon, London, 1694. Book III., Chapter II., p. 494.

After all, those of our race should be the last to be squeamish concerning the toilet functions of the fifth digit. With us it is not a case of fingers were made before forks, for we have not yet invented the successful fork unless the rolled up edge of the towel so much and so rightly dreaded by the child can be accounted as such. The fork, or its equivalent, has, however, been invented by others. Few, if any, of the Asiatic races are without a definite instrument for cleaning the external auditory meatus. In the splendid coils of her black hair the Malay woman wears a little silver pin some six inches long; one end of this ornament is pointed, the other, which is crooked, is fashioned like a tiny spoon. This is the Korek Kuping, and, though it is an ornament worn becomingly in the hair, it is also a functional instrument, the use of which is the toilet of the external ear. (See Figure 1.) Fingers were made before Korek Kupings, and

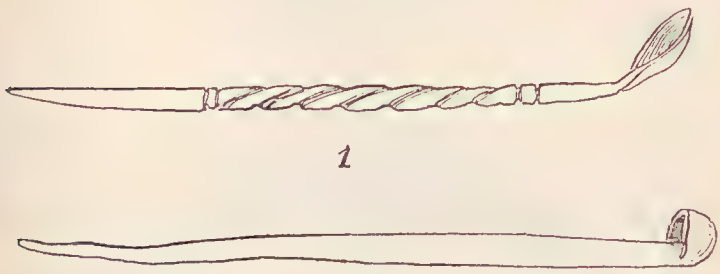

Figure 1.—Two examples of the Korek Kuping—the toilet implement of the ear. (1) A Malayan and (2) a Chinese specimen.

we—though it may be on the sly—still employ the fifth digit of the manus for the office the Korek Kuping was designed to discharge. Although we have ceased to name it Auricularis, we still, behind closed doors, demonstrate the appropriateness of that name. It may even be suggested that the adoption of an instrumental Auricularis, such as is employed by Asiatic races, would be a movement in the direction of toilet refinement. It is true that such an instrument has been invented, and has been made available in chemists' shops. This invention, however, which was known as an "aurilave," was branded by the contemporary aural surgeon (C. H. Burnett, *The Ear*, 1884) as "that most pernicious "and reprehensible instrument," and, so far as I know, aurilaves enjoy no present-day popularity.

If we open the mouth of a dog and look at the margin of his lips we see that the condition differs very widely from that which we see when we look inside our own lips. The margins of the lips of a dog, or indeed of the lips of most mammals, are beset with curious little tags and frills. (See Figure 2.) These little tags are processes of the substance

Figure 2.—The mouth of a Wolf Cub with the cheek removed, to show the papillæ growing from the lip and from the side of the tongue.

of the lips, bluntly pointed at the ends, and clothed with a surface epithelium, which is almost horny in its nature. If this frilled fringe of the lip is left in apposition with the teeth it will be noticed that the little processes lie against the teeth and that, when the lip is moved, the tags work up and down along the interspaces between the teeth and on the surfaces of the teeth themselves. If we look further into the mouth we shall notice that, on the inner side of the tooth row, there are other tags developed from the side of the tongue, or from a fold below the tongue. The outer row of tags, or labial processes, are variable in form in different mammals, but are constant in site, inasmuch as they arise from the margin of the lips. The inner row of tags may arise either from the sides of the tongue itself or from certain folds, the *plica sub-linguali*s or the *plica fimbriata*, below it. (See Figure 3.) All of us have admired the clean white teeth which most animals possess; and those who have regarded rats as being unclean, because their teeth are yellow, forget that the yellow colour is natural to the enamel of their incisors. The beautifully clean white teeth of the carnivora know no artificial tooth brush; they are innocent of tooth powder, tooth paste, or tooth pick. They are cleaned in the

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common mammalian fashion by the play of the little rubber fingers of the lips and tongue.

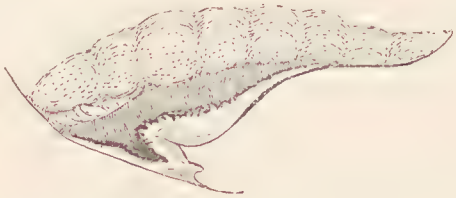

Figure 3.—The tongue of the Flying Opossum (*Petaurus breviceps*), to show the fringe of papillæ (plica fimbriata and plica sublingualis) along its side.

In the Primates these little tags are lacking, but it is not to be forgotten that the human child at birth shows a condition in which the lips are beset with little papillæ which seem obviously to be remnants of those which are present as a common mammalian heritage. (See Figure 4.) In the

Figure 4.—The lips of a new-born baby, to show the little papillæ with which they are clothed (after Ramm).

Primates the intimate tooth cleansers seem to have been subordinated to the activities of the digits.

We have our tooth brushes and our innumerable dentifrices, but we must remember that our tooth brushes, by working along the line of our teeth and not up and down, as do the labial and lingual processes, are not so effective in cleansing inter-dental spaces as are Nature's methods. Nor must we forget that European tooth brushes are not the only kind invented by man, for many races use a brush which is applied up and down as are the lost intimate tooth cleansers. Such tooth brushes, which are very like the frayed-out ends of wooden meat skewers, are widely used, but though put on the European market have, I believe, never proved acceptable to European taste.

Even the up and down tooth brush does not exhaust the aids to dental cleanliness employed by some races, and for a complete armamentarium for the dental toilet probably the Chinese is as well equipped as any man. Perhaps it may here be said without shame that, for what may be termed the general toilet of the mouth, the European lags far behind the Asiatic. We Europeans have our tooth picks, which enjoy a curiously anomalous acceptance midway between covert usage and open display upon restaurant tables. These articles may be purchased expensively, wrought of gold and silver, or cheaply when made of wood or quill; but their recognition is only partial. They are not employed overtly as the tooth brush, the neglect of which is shame, they are not unknown as is the Korek Kuping; they are in a stage of recognition as implements but of disfavour as to public employment. We do not know if their usage is of the right hand or the left.

Fingers were made before tooth brushes and tooth picks; but before fingers there came a whole series of beautiful adaptations to the local mechanism of cleansing the teeth.

As with the ears and with the teeth, so with every other external part which may need toilet attentions.

No more delicate external organ than the eye can well be imagined; and although we must not fall into the popular error of supposing that eyelids are developed purely for the purpose of protecting or cleansing the eye, we must not overlook their office in this matter.

There is a very attractive Gecko, which is widely distributed in Australia, but does not extend its range to Tasmania, named *Gymnodactylus miliusi*, which in Australia has almost become legendary as the "Wagga," which stands on its hind legs, barks like a dog, and bites severely and venomously. It is a charming and harmless creature, which is certainly vocal and certainly stands erect on the tips of the toes of all four feet; but beyond that does nothing outrageous. Like all Geckos, it lacks moveable eyelids; but lacking one instrument, it uses another, and its tongue replaces the absent eyelids in the office of removing particles from the surface of the eye. *Gymnodactylus miliusi* has an attractive habit of solemnly sweeping its tongue over the surface of its eyes, and probably other Geckos can do the same. But though Geckos and other animals may employ expedients of this sort, the real mechanism for conducting

the toilet of the eye is the third eyelid, or nictitating membrane, acting in conjunction with the upper and lower lids. Though the upper and lower lids have other functions to perform—the third eyelid is a toilet implement pure and simple—its function is to sweep across the eye and remove particles and draw them across to the inner corner of the eye. It works like the Gecko's tongue. In all the monkeys this third eyelid is a mere rudiment, just as it is in man, but in some mammals it is of considerable size. As Robert Knox observed, "The third eyelid, perceptible enough in man, "though clearly a vestige; more developed in the ox, horse, "dog; still more in the elephant; most of all in the bird— "ever the same elements nearly are found in all; it is merely "a question of size and function, but not of kind or "organisation." (3)

We are so used to being able to remove foreign bodies from the inner corners of our eyes by the use of our finger tips that it is difficult to picture the condition in those animals in which no instrument save the innate toilet mechanism of the eye exists.

It would seem that the mobile, inquisitive, and resourceful finger had usurped the functions of many very beautiful mechanisms, and let it be remembered that in the three simple examples of the ear, the teeth, and the eye, which have been instanced by way of introduction, we have only invaded the marches of this great realm of the special digital toilet.

Would you hand the sweetmeats to a son of Islam you must elect the right hand for that office; for there is a specialisation in the usage of the hands for offices polite or impolite. I have, in the examples I have cited, chosen somewhat from the right handed offices of our digits. Not only have we limited ourselves to the more or less honourable use of the digits, we have also limited ourselves to certain special portions of the body, which may be defined as the orifices of certain sense organs—though from choice we have left the nose out of account. In all this we have not considered the great question of the toilet of the general surface of the body, the toilet of the coat, the business of keeping the whole of the skin and hair orderly and clean. In this business many mechanisms play, or have played, their parts, and we should look to see wide differences in the toilet appliances, for there are wide differences in type of

(3) Robert Knox, *Great Artists and Great Anatomists*, 1852, p. 196.

the toilet to be performed. A hairy coat is the birth-right and the hall-mark of the mammal, but the nature of the hairy coat varies widely, since a mammal may be clothed with spines or bristles, with harsh, coarse hair, with fine silky, velvety, or woolly fur, or it may be relatively or absolutely naked.

For all sorts and conditions of spines, hairs, and furs there must be a special and definite toilet and a definite toilet mechanism. There is also another consideration; there may be parasites of very varying types that find lodgment in the coats or upon the skin of the animal. The presence and the nature of parasites are important factors, and they have probably played a conspicuous part in the begetting and moulding of toilet implements.

We brush our hair when we rise in the morning, we may do it again in between times and before we retire at night. Animals perform the toilet of the coat at very varied intervals; some do it only when the call is imperative, some perform it almost without ceasing during their waking hours. As a homely example, the cat is for ever at its toilet when not otherwise employed; the dog devotes its energies to a good scratch only when the insistent attentions of a flea, or something of the sort, have evoked an imperative desire to scratch. In this very homely illustration there lies a deep physiological truth. The dog possesses the well-known "scratch reflex"; tickle his front ribs, and his hind legs will start scratching movements in response. The cat has no such generalised reflex, save for a slight local manifestation around the ears. You may tickle a cat's ribs as long as you care to do it, but you will never produce a sympathetic twitch in its hind leg, such as may be evoked on an instant in a dog. The coat toilet of the cat is a deliberate operation, the occupation of a well-employed leisure. The coat toilet of the dog is a reflex and unconsidered affair, imperative, utilitarian, and unæsthetic in its manifestation.

There are many ways in which the toilet of the surface of the body may be conducted, and in order to introduce some system into their study it is best to take the different methods and examine them separately.

(1) BY RUBBING AGAINST EXTERNAL OBJECTS.

This may be termed the method of the itching post, and it is a favourite method with certain animals that lack toilet implements of their own.

It is because of the general lack of toilet implements among the *Ungulata* that this rubbing against posts and trees has become so characteristic of them. The hoof prohibits scratching. As the animal cannot scratch itself, it must find something which will do the scratching for it. It invents a toilet implement; though it has not made a fork it has found an itching post.

(2) BY BRUSHING OR FLICKING WITH THE TAIL.

These methods play no great part in the toilet of the coat as we are here considering it, nevertheless they are important enough from the point of view of the animal. It is again in the *Ungulata*, cursed with the hoof instead of the hand, that the tail functions so predominantly as a toilet organ. In the study of structure and function, it would perhaps be difficult to find an organ of such outstanding interest as the tail. This dead end of the vertebrate body, left over after the body and its organs are fashioned, is ever available for some office. The various uses that have been made of it afford material for a bulky thesis.

Could John Hunter, the Very Revd. William Paley, and Samuel Butler have entered into partnership and produced a joint work upon the uses of the tail we would have had a regard for the tail almost as great as we have at present for monkey glands or pituitary bodies. The mammalian uses of the tail are legion; in comparatively few animals does it function as an instrument of the toilet, and then its office is called upon only because some other, and more customary, instruments are at fault. The horse, for instance, relies on its tail to perform the office that would be fulfilled by the teeth or the claws of a dog.

(3) BY SCRATCHING WITH HORNS OR ANTLERS.

This method of conducting the toilet of the coat is again a limited one, and one that does not lead us far. As with the itching post and the tail, it is mainly a toilet substitute of the *Ungulata*. Scratching with horns and antlers is necessarily limited in its manifestations in the mammalia; it is limited also, even in the horn-bearing animals, to the parts of the body to which it can be applied. A stag, an antelope, or a cow can scratch only a limited part of its body with its antler or its horn. Although these things play a definite rôle in the toilet of the coat, their rôle is limited in area and limited in its display among the mammals.

(4) BY TWITCHING WITH MUSCLES.

Everyone has seen this simple toilet operation performed by a horse; the little flicker that runs beneath and shakes the skin is familiar to everyone. The special subcutaneous muscle sheet which produces this twitching is very variably developed, and is put to many uses in different animals; as a toilet muscle its great function is to dislodge from the skin flies, parasites, and foreign particles which lodge upon portions of the body difficult to reach with any other toilet instrument. For our present purpose the panniculus carnosus sheet, which is a toilet muscle in so far as it is a twitching muscle, is of only minor importance, although twitching as a fine art is seen at its best among the marsupials.

(5) BY LICKING WITH THE TONGUE.

The tongue is in very different case from the other toilet instruments we have reviewed. The tongue—the member most unjustly named unruly—is one of the most perfectly adjusted neuro-muscular mechanisms in the body. A marvel for precise action, a revelation for obedience to cortical control, the tongue seems ever ready to take on new offices. Among these offices a conspicuous one is that of conducting the toilet of the coat by the process of licking. Although it is a simple thing to watch animals and to appreciate the enormous importance of the tongue as a toilet instrument, it is by no means easy to determine what modifications of the tongue itself are due to its toilet offices. In writing of the Lion's tongue, Flower and Lydekker (4) say:—

"The tongue, like that of every other species of the "genus, is long and flat, and remarkable for the development "of the papillæ of the dorsal surface, which (except near the "edge) are modified so as to resemble long, compressed, re-"curved, horny spines or claws; those near the middle line "attaining the length of one-fifth of an inch. They give the "part of the tongue on which they occur the appearance and "feel of a coarse rasp, and serve the purpose of such an "instrument in cleaning the flesh from the bones of the "animals on which the Lions feed." This rasping flesh from bone is a business of which we have all been told, and I would not dispute that it indeed may be an important matter. That the curious roughness of the tongue of the cats is in reality begot for flesh-rasping is to my mind a

(4) *An Introduction to the Study of Mammals, living and extinct*, 1891, p. 507.

very doubtful supposition. I think it may be contended that among the functions for which this peculiar roughness would be required, the business of coat toilet far outweighs that of flesh-rasping when we come to observe the habits of, even, a domestic cat. Although the flesh-rasping function has become the accepted and traditional explanation of the peculiar rasp-like nature of the tongues of the *Felidæ*, I feel certain that the brush-and-comb tongue is essentially a toilet implement, and that the flesh-rasping habit is rather a minor one, magnified in order to explain a very peculiar structure. In such a study as this we must not forget that apparent triviality may be compensated for by frequency; a condition that is often not duly considered. The toilet of the Feline's coat is a never-ending business, for every once that a cat's tongue is called upon to rasp flesh from bone it is employed a hundred times as brush and comb and sponge in one.

The toilet of the cats is a remarkable affair, and one well worth watching. It will be noted that the animal licks all parts of its body that are within direct reach of its tongue, and the tongue can reach almost all its body save the sides of the face, the top of the head, and the back of the neck. In order to conduct the toilet of these parts the cats have perfected a toilet process, which, so far as I know, is confined to them; they lick the side of the paw and cleanse the head and face with that. This use of the furry manus as a sponge is, I believe, unique with the *Felidæ*, but I by no means feel prepared to uphold the thesis that, when the operation is carried to the backs of the ears, rain is likely to follow.

It is not only cats and the other members of the *Felidæ* that lick their fur for the purposes of the toilet. Many marsupials lick wide areas of the body; but here only a certain element of this extensive operation may rightly be claimed as a toilet process. I do not know that it has been sufficiently appreciated that this extensive licking of the marsupials is merely a substitute for perspiration. In very hot weather, dogs, which cannot sweat, loll out their tongues and evaporate moisture from the wet surface. This is a substitute for sweating. Many marsupials, such as opossums and kangaroos, when distressed by the heat, lick the whole of the forelimbs, and with increasing need for heat radiation moisten large areas of the body by means of licking with

the tongue. This operation must not be mistaken for a procedure for conducting the toilet. It is merely a means of providing an evaporating surface, in the absence of sweat glands. There is, however, in almost all marsupials a residual licking, which is purely a toilet operation, and this is the business common to all mammals that, to use the recognised expression, lick their chaps. Apart from the elaborate feline tongue-toilet, and apart from the common mammalian process of the licking of the chaps, many animals have a limited toilet of the coat which is conducted by the tongue. Most *Ungulata* lick these portions of the body (and they are limited) which can be reached with the tongue. Everybody has seen a cow turn its head and lick the very small area available to the exploration of its tongue. There is an interesting sequel to this business of licking the coat. Should the condition of the coat be below normal, the tongue toilet becomes increasingly necessary. The accumulated hairs licked from the coat must be got rid of, just as we must remove the hairs from hair brushes and hair combs. Under normal conditions it is to be presumed these hairs are either ejected from the mouth or swallowed. In any case the amount of hair to be disposed of as the result of any individual toilet operation would be inconsiderable. But if the animal happened to be shedding its coat, it is possible that after each overhauling of the coat by the tongue a relatively large mass of hair is taken into the mouth, and the bulk of this will be swallowed. In this way result those homely products, elevated by age-long legend into the realms of the mysterious and occult; the simple or calcified hair balls of the pathologist, the fabulous, the priceless, the incomparably potent antidotes of the alchemist. Of these things Gaspar Schottus (5) wrote:—"Quam notus est lapis, quem Bezoar alii, alii "Bezaar, et alii Belzaar, hoc est (ut ajunt) veneni dominum, "seu veneno dominantem appellant"; and then the author tells much of mysteries and goats from the Indies which do not appropriately come under the heading of the Mammalian Toilet. Taking it all round, from the rasps of the Lion's tongue to the Bezoar stone of the *Capra bezoardica*, the business of the coat toilet conducted by the tongue is a large one, and it must be remembered that here we have only mentioned self-licking; there is a wide extension of the subject when we also take into consideration mother-conducted and mutual licking.

(5) *Physica curiosa*, 1667, Liber VIII., p. 858.

(6) BY COMBING WITH THE TEETH.

In the business of combing the fur with the teeth lies, from an historical point of view, perhaps the greatest interest attached to any of the toilet implements. It was Cuvier who, in 1829, called attention to the function of the curious procumbent lower incisors and canines in the Lemurs. When describing *Lemur catta*, Cuvier mentioned a curious habit, and he recorded that:—"Ces animaux sont portés, par "leur instinct, à se gratter mutuellement avec ces dents, qui "semblent ne leur avoir été donnés que pour nettoyer leur "pelage; car ils ne s'en servent jamais ni pour mordre, ni "pour couper; ce sont de véritables peignes." (6) This simple observation, made nearly a century ago, has often been overlooked by succeeding generations of zoologists; but of its accuracy there can be no doubt whatever. The four lower incisors of the Lemurs have become altered in form and in position, and, moreover, the lower canines have also participated in the change, and have become so thoroughly modified in the same direction as the incisors (see Figure 5) that they have frequently been mistaken

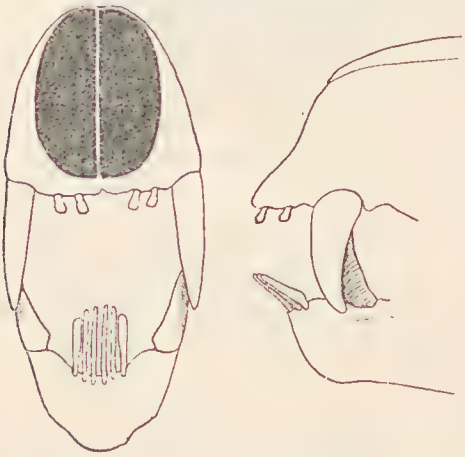

Figure 5.—The front teeth of a Lemur (*Lemur catta*), to show the adaptation of the six lower anterior teeth to the purpose of a hair comb.

as being incisors themselves. These six lower teeth have become elongated and compressed from side to side; in form they can only be likened to the teeth of a comb. They have also become altered in position, so that, instead of being

(6) Geoffroy Saint-Hilaire et F. Cuvier, *Histoire naturelle des Mammifères*, 1829, p. 218.

directed towards their fellows in the upper jaw, they project almost straight forward. In consequence of this alteration in their axis the upper incisors are left without anything to bite against, and they have become reduced and probably almost functionless structures. There is no doubting the anatomical fitness of these lower front teeth for the office of a hair comb; there is no doubting the frequency with which they are put to that use by the Lemur. One has only to watch a waking Lemur for a short while in order to witness the use of the dental hair comb. Carefully, with downward strokes, the hair comb is passed through the hair. An efficient instrument, there is no denying it, and one well adapted to the peculiar woolly fur of the Lemur. When we realise that the peculiar form of the lower front teeth of the Lemur is the result of specialisation effected for the elaboration of a hair comb, we obtain the clue to the functions of another remarkable feature of lemurine anatomy.

We have previously mentioned the little tags found within the mouth of some animals; and these little tags we have postulated as being functional tooth cleansers. The lower front teeth of the Lemur, being no ordinary teeth, but hair combs, need an extraordinary tooth brush. This tooth brush is present in the form of the remarkable development of the lemurine sublingua. Although the real use of the sublingua was probably known to many observers of animals, to science it remained a mysterious structure.

In 1918, as the result of watching Lemurs at their toilet, I published an account of the functional rôle of the sublingua. (7) When a Lemur has conducted the toilet of those parts of its body that it can reach with its dental hair comb, it rapidly moves the sublingua backwards and forwards over the comb, and with its little horny processes removes the débris from its teeth. (See Figure 6.) The woolly-

Figure 6.—The tongue of a Lemur, to show the so-called sublingua (plica fimbriata) adapted to the cleansing of the dental hair comb.

(7) *Journal of Anatomy and Physiology*, Vol. LII., p. 345-353.

ecated Lemurs, which have nails instead of claws on all their fingers, and only one claw on their toes, are provided, nevertheless, with a complete hair comb and a most efficient brush for cleansing the comb.

A curious parallel structure in the nature of a dental hair comb is seen in the so-called Flying Lemur (*Galeopithecus volans*). The Flying Lemur is not a real Lemur, but it has a real dental hair comb, and this hair comb, though having the same function, is made in an altogether different way. In the true Lemurs six teeth are raked forwards so that each individual tooth constitutes a tooth of the comb; in the Flying Lemur the front teeth themselves are pectinated at their free edges, so that each individual incisor tooth furnishes many teeth for the comb. (See Figure 7.)

Figure 7.—The mouth of the Flying Lemur (*Galeopithecus volans*), to show the pectinated lower incisor teeth and the anterior, pectinated, edge of the tongue.

In this way there is an economy in the sacrificing of individual teeth for the composition of the comb, and in *Galeopithecus* there is no need for the canines to come forward and assume the form of incisors, but, on the other hand, they become modified in the direction of the molar series.

Just as the true Lemurs have developed their tooth brushes from the sublingua, so has *Galeopithecus* produced a harmonious structure, but it is made, not from the sublingua, but from the tongue itself. The anterior edge of the tongue of *Galeopithecus* is finely serrated, the serrations being used, so one imagines, for working in the interstices of the dental serrations, as the sublingua of the Lemurs works in the intervals between the individual teeth. I think that none would be likely to doubt this interpretation of the

Lemur's procumbent lower teeth and of its specialised sublingua. Certainly no one would doubt it had they watched a Lemur at its toilet. With *Galeopithecus*, so far as I know, no observations have been made on the living animal, and it may be that some would shrink from assigning a toilet function to the curious lower incisors, to which no other function, demanding the special development of the pectinated edge, has been assigned.

When discussing this matter seven years ago I suggested that the reason for the development of the dental hair comb and lingual tooth brush in *Galeopithecus* was to be found in the fact that its manus was hampered from performing toilet operations by reason of its incorporation in the flying membrane. At that time, not being concerned with the question of dental modifications for toilet purposes, I carried the matter no further; but it is difficult to know, to-day, just how far the matter can be carried. Take a further extension of the argument applied at that time to *Galeopithecus*. If the incorporation of the manus in a flying membrane might beget dental hair combs by reason of the manus being thrown out of toilet employment, then the Bats, one would imagine, might show some such specialisation. It may be that many mammalogists would not agree that the curious lower incisors of the *Microchiroptera*, or Insectivorous Bats, were highly specialised teeth, modified for the requirements of the toilet. We have seen that, with the development of a dental hair comb from the lower front teeth of the Lemur, the upper front teeth tend to become functionless and to undergo reduction. In the *Microchiroptera* this reduction of the upper front teeth, with the accompanying serration of the edges of the lower front teeth, is carried to extremes.

Opportunities for watching the *Microchiroptera* at their toilet are not easily come by, and it has not fallen to my lot to observe an Insectivorous Bat carry out the toilet of its coat since the peculiarities of its lower front teeth have attracted my attention. In the absence of direct observation upon this point it is, therefore, only possible to suggest—it is not possible to assert—that the curious serrated lower incisors of the *Microchiroptera* are modifications that are associated with the toilet requirements of animals deprived of the toilet uses of the manus. (See Figure 8.)

Observations on the life histories and habits of our native Bats are sadly wanting, and I would recommend to

our field naturalists the study of living Bats. If this study be carried out, I feel sure that it will be observed that some portion of the Bat's body, probably the ventral surface and the shoulders, is subjected to a combing by the curious serrated lower incisor teeth.

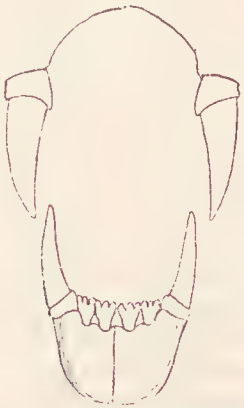

Figure 8.—The anterior teeth of an Australian Bat (*Taphozous flaviventris*), to show the pectinated lower incisors and the absence of upper incisors.

It is impossible, within the compass of this review, to deal with the innumerable possible toilet modifications of the front teeth of mammals. Only this may be asserted, that as observations on living animals are accurately recorded so will our appreciation of the front teeth as toilet implements grow.

Here we may confine ourselves to native animals upon which observations are easy to make, and concerning which assertions as to habits and structure are easy to check. The marsupial animals are traditionally divided into two sections—the *Polyprotodontia* and the *Diprotodontia*. The one section has many small front teeth, the other has few and large front teeth. There is, however, another possible division of the marsupialia into two other divisions—the *Didactyla* and the *Syndactyla*, the one section having normal pedal digits, the other having the second and third digits conjoined. With the exception of one family (*Peramelidæ*), the *Polyprotodontia* are *Didactyla*, and the *Diprotodontia* are *Syndactyla*. Put into ordinary language, this means that (with the exception of one family) all the marsupials having small front teeth have normal, simple, digits, whilst all the marsupials

having few and large front teeth possess the specialised syndactylous pedal digits. Surely there must be some underlying correlation in this. The syndactylous pedal digits seem to be begot when the front teeth become few. As we shall see later, the syndactylous pedal digits constitute an undoubted toilet implement. Do they then replace the many small front teeth which are themselves toilet implements? From observations on living polyprotodont didactylous marsupials I certainly think this is so. I have come to regard the specialised incisors of the *Didactyla* as being toilet modifications, and this as a consequence of repeated observations of their use for the purposes of the toilet. To this subject I have already called attention (8), and here it is only necessary to recapitulate, in a brief manner, the results previously recorded.

I have had examples of Krefft's Pouched Mouse (*Dasycercus cristicauda*) under close observation for upwards of four years, and the detailed toilet of the coat has been repeatedly witnessed in these animals. (See Figure 9.)

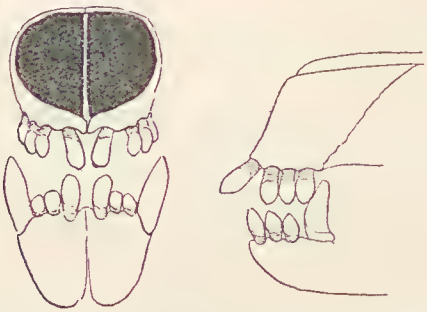

Figure 9.—The front teeth of Krefft's Pouched Mouse (*Dasycercus cristicauda*), showing the specialised central incisors.

These attractive little marsupials scratch themselves vigorously with the digits of the pes; but if any part of their body demands special attention they turn their heads and nibble and comb their hair in a very characteristic fashion. From these observations I have been for some time convinced that the front teeth and the syndactylous digits were complementary structures, vicariously discharging the same functions; and have already suggested that the little sharp front teeth of certain other animals are probably of more importance as toilet implements than as organs connected

(8) *Mammals of South Australia*, 1924, Part II., p. 135, and *Trans. Roy. Soc. South Aust.*, Vol. XLVIII., p. 187, 1924.

with alimentation. It is only of late, however, that, in watching *Dasycercus* at its toilet, I have come to realise that there is a remarkable specialisation of its front teeth, which is, as far as I can determine, related solely to the function of hair combing. Of the eight incisors carried in the upper jaw, two, the central members, are in every way abnormal. These two teeth are remarkable, not only in their form, but in the axis in which they are carried in the jaw, for they rake forward at an agle which carries them out of alignment with all the rest of the teeth. So marked is this projection of the upper central incisors that, in the normal position of the jaws, they do not articulate with the corresponding members of the mandibular series. The upper central incisors are large teeth, larger and longer than their fellows, from which they are separated by an interval which exceeds their own diameter. They are also separated from each other by a slightly smaller interval in the mid line, and at their tips they somewhat tend to approach each other. The corresponding lower central incisors are also specialised, being considerably longer and larger than their fellows, and separated from each other in the mid line by an interval similar to that which separates the incisors of the upper jaw. When the jaws are opened and shut it will be seen that these specialised front teeth do not bite together as the other incisors do, but the lower centrals close behind the upper centrals, their "occlusal" surfaces failing to articulate. It is impossible, after having watched the animal at its toilet, to avoid the conclusion that these specialised, projecting incisors, separated by a median gap, are the functional counterpart of the little parallel claws of the syndactylous pedal digits. Indeed, it is difficult to postulate any other function from them.

Dasycercus is not the only didactylous didelphian exhibiting this specialisation of the anterior teeth, for, with the exception of *Sarcophilus*, all the species that I have been able to examine show the peculiarity in some degree. The various members of the genus *Phascogale* display the long, projecting, upper central incisors in a still higher degree of specialisation, and the condition is well seen in *Phascogale penicillata*. (See Figure 10.)

In the Native Cats the differentiation of the front teeth is not so pronounced, but, nevertheless, the peculiarity is quite obvious, for the upper central incisors cant forwards and are separated from each other and from their fellows.

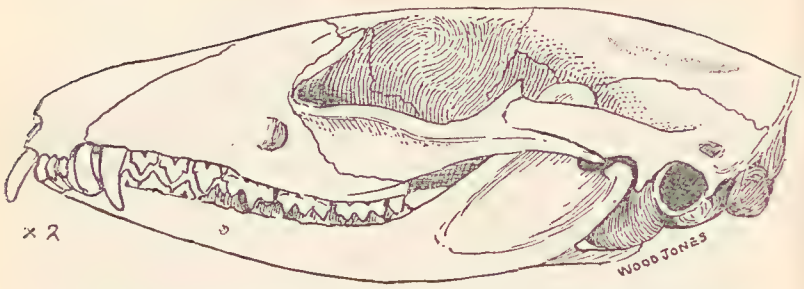

Figure 10.—Skull of the Brush-tailed Pouched Mouse (*Phascogale penicillata*), to show the projecting upper central incisors.

The lower central incisors are also large, distinct in form, and separated in the mid line.

Perhaps the most interesting modification of the anterior teeth is that seen in *Myrmecobius*, for here it is the lower incisors that are the most highly specialised, the upper central incisors being very small, but sharply pointed. In *Myrmecobius* the teeth are more widely separated in the mid line than they are in the Pouched Mouse, and it is to be hazarded if this modification is associated with the coarse, hispid hairs which constitute the animal's coat. The lower central incisors of *Myrmecobius* are relatively very large teeth, and are peculiar in their form. The special interest attached to these teeth of the Numbat lies in the fact that the dentition of the creature is obviously in a state of degeneration. In the midst of this degeneration the two lower central incisors stand out in marked contrast, and it might almost be said that they are practically the only undegenerate teeth that the animal possesses. (See Figure 11.)

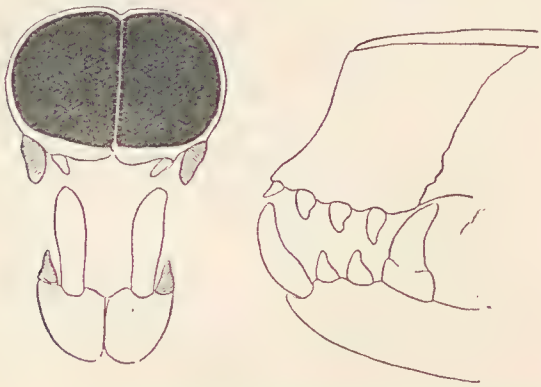

Figure 11.—The front teeth of the Banded Ant-Eater (*Myrmecobius fasciatus*), to show the specialised lower central incisors.

From the refined toilet of the coat by the dental hair comb of the Lemur to the casual nibbling at the site of the operations of an importunate flea, as witnessed in the dog, there is evidently a gradation in the toilet usage of the front teeth in the mammals. There still remains the question of the correlation of the two divisions of the Australian marsupials into the *Polyprotodontia* and *Diprotodontia* and the *Didactyla* and the *Syndactyla*.

We have seen that all the Australian marsupial animals, with the exception of the family *Peramelidæ*, which possess many small front teeth, have no specialisation of toilet digits on the pes, and that all the Australian marsupial animals possessing few and large front teeth have, without exception, the specialised syndactylous toilet digits.

The *Peramelidæ* (Bandicoots) are, therefore, in an anomalous position, for they have many front teeth and also possess the specialised pedal toilet digits. It is true that the Bandicoots possess the many front teeth, they have five upper and three lower incisors upon each side of the jaw, but the incisors are no longer of the type seen in the rest of the Polyprotodonts; they have lost their pointed, prong-like character, and have become chisel-shaped. It is not, therefore, the quantity of front teeth, but the quality of them which determines their use as toilet implements. The *Peramelidæ* have many front teeth, but these front teeth, being useless for the toilet of the coat, have been supplanted by the syndactylous toilet digits of the pes.

(7) BY BRUSHING WITH A SPECIALISED HAIR BRUSH.

How common mammalian hair brushes are, and upon what parts they may be developed, I do not know, but when we take into consideration the perfection of one of these organs it seems not unlikely that others, possibly less perfect, exist.

An excellent account of the toilet of a Free-tailed Bat—*Nyctinomus brasiliensis*—was published in 1865. The description was written by Mr. W. Osborn in Jamaica. Referring to the toilet of the Bats, he says: "The luxury King "James thought too great for subjects, and ought to be "reserved for kings, is largely indulged in by Bats. First "one and then another wakes up, and, withdrawing one leg "and leaving himself suspended by the other alone, adroitly "uses the foot at liberty as a comb, with a rapid effective

"movement dressing the fur of the underpart and head—an "action far from ungraceful. The foot is then cleaned "quickly with the teeth or tongue, and restored to its first "use. Then the other leg does duty. Perhaps the hairs with "which the foot is set may add to this end. I often have "seen them do this in confinement; and probably the numerous "Bat-flies with which they are infested may be the cause "of extra dressing." The suggestion that the hairs that spring from the lateral digits of the pes aid in carrying out the toilet of the coat is, so far as I know, the first allusion to one of the most remarkable toilet appliances seen in the mammals. Among the distinguishing features of the Molossine Bats is the character that "the feet are broad, the "outer and inner toes much thickened and larger than the "others, and furnished with long curved prehensile hairs." (9) I think it would be a mistake to suppose that these hairs had a prehensile function. No hint of their being useful in this way can be gleaned from watching living examples of our common Molossine Bat—*Nyctinomus australis*—but on the other hand this Bat will readily demonstrate the truth of Osborn's observations on the Jamaican member of the Genus.

In some Bats the brush is confined to the first digit only, and then this digit is considerably stouter than any of the others; in our Free-tailed Bats the marginal digits, the first and the fifth, are both thickened and both furnished with brushes. The brush is a complex and beautiful structure. The hairs composing it are stiff and bristle-like, and each is crooked at its tip. The hairs project from the margin of the first and fifth digits, and are so arranged that their free extremities all end on a common level, the outer hairs being longest, the inner ones shortest. The recurved tips of the hairs are a striking peculiarity, for each bristle is bent at a right angle just short of its tip. (See Figure 12.) The little hooked ends of the hairs are so arranged that the free tips are directed towards the middle line of the foot. In this way the little brush functions somewhat after the fashion of a rake, and after it has been passed through the soft fur it leaves its furrowed imprint clearly defined.

Probably this molossine hair brush is not unique in the mammals, and it is to be noted that, in the sense that it is a flange added to the side of a digit, it somewhat recalls the

(9) Dobson, G. E., *Catalogue of the Chiroptera in the British Museum*, 1878, p. 403.

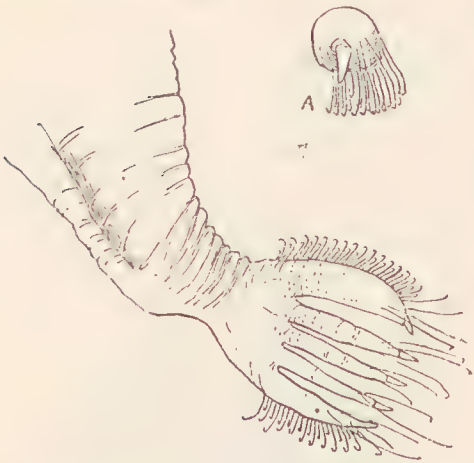

Figure 12.—The pedal hair brush of a Free-tailed Bat (*Nyctinomus australis*), which inhabits Australia and Tasmania.

avian pectinated preening claw which has recently been thoroughly re-investigated in Australian birds by Dr. A. M. Morgan. (10) It is of interest that in Osborn's account of the use of this hair brush the teeth or the tongue are ultimately called upon to cleanse the brush. Here again is seen the sequence we noted in the Lemur; the specialised toilet implement needs a mechanism for its own cleansing.

(8) BY SCRATCHING OR COMBING WITH NAILS OR CLAWS.

Here we may encounter mere generalised scratching, with claws not specially modified for this purpose, or we may meet a deliberate toilet carried out by a definite toilet implement fashioned from claws specialised for this purpose. Of the general use of the human nails for the purpose of the toilet an anonymous author wrote in 1724 (11) :— "A further Use of the Nails is, that they, like Hooks, are "serviceable in drawing anything to us, and are Weapons "to defend us from the Trouble that arises to us from some "small living Creatures that often make their Habitation "upon the Surface of our Bodies, and to allay the uneasy "Titillation by scratching."

(10) The Pectinate Middle Claw in Australian birds, *South Australian Ornithologist*, Vol. VIII., part 2, March, 1925, p. 44.

(11) *An Essay concerning the Infinite Wisdom of God, manifested in the Contrivance and Structure of the Skin of Human Bodies.* By a Lover of Physick and Surgery. 1724. p. 9.

Although we have seen that in certain very remarkable directions our several fingers are allotted separate toilet offices, nevertheless, all unite in discharging the general business of body scratching when this scratching is done on a large scale. But for what might be termed precise and localised scratching the index finger is the elected member. In many other animals this election and specialisation of a scratching toilet digit goes much further, and a definite toilet implement is begot. It is impossible here to trace the office of the nails as toilet implements through the whole of the mammalia, a vast amount of observation must be carried out and recorded before the facts are available. We must content ourselves with noting one or two outstanding examples among the higher mammals, and then confining our attention to the Monotremes and Marsupials where assertions as to behaviour and the use of toilet digits may readily be checked by watching the living animals.

We have previously noted the dental hair comb of the Lemurs; but this is not their only toilet implement. They possess a pedal hair comb also. Lemurs are peculiar in that though flat nails are developed on all the digits of the manus and on four digits of the pes, the second pedal digit bears a strong erect claw. Of *Lemur mongos* Cuvier recorded (12) :—"Nous ne les avons jamais vus se serve de cet ongle à autre "chose qu'a l'introduire dans leurs orielles." This strange nail may, therefore, function in the special toilet of the ear as well as in the wider office of tending the general coat toilet. (See Figure 13.)

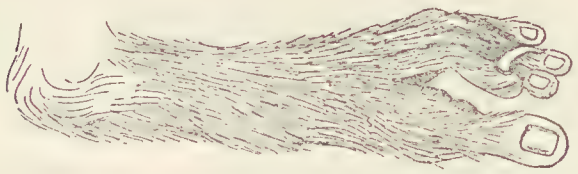

Figure 13.—The pes of a Lemur, to show the only claw—that of the second pedal digit—the animal possesses.

One of the most remarkable toilet digits, the function of which seems to have had little attention devoted to it, is the greatly elongated claw of the second pedal digit of *Echidna*. That the great claw is a toilet implement there is no doubt;

(12) *Op. cit. sup.*, p. 214.

it is begot for scratching down to the roots of the spines, and the length of the claw is in proportion to the length of the spines. In the very much larger and longer spined race of *Echidna*, which lives in the South-eastern portion of South Australia, the claw of the second pedal digit is harmoniously enlarged. In the small-spined form of *Echidna* that inhabits Kangaroo Island the toilet digit measures 35 mm., while in the long-spined Southern South Australian form it has increased to 50 mm. (See Figure 14.)

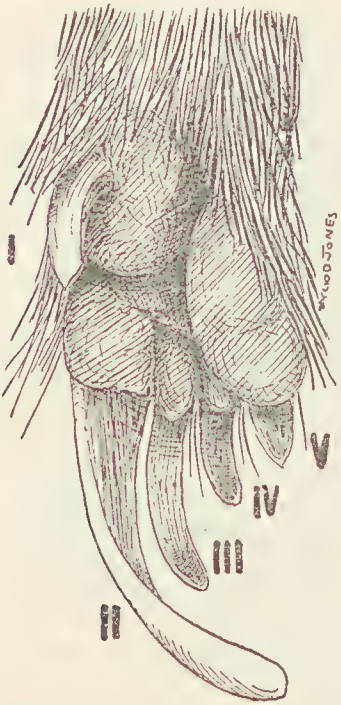

Figure 14.—The enlarged claw of the second pedal digit of the common Spiny Ant-eater (*Echidna*).

It is to be noted that the pedal toilet digit of *Echidna* is the same member of the series as that of the *Lemur;* and we may make a generalisation and say that the hall-mark of pedal toilet digits is that they tend to be on the inner side of the foot and on the inner margin of the digit. This is the side of the foot and the side of the digit most readily brought into apposition with the body in performing what may be called the down stroke of scratching. The

pectinated claw of the birds follows the same rule. With most animals the first pedal digit is too valuable for its own sake to be given over to the toilet, and the second accepts the office. But where the first digit has lost this value, as in the Bats, it becomes the toilet digit of the pes, and in certain Bats an exceptional implement is placed on the fifth digit; Bats being apparently capable of passing their feet over parts of their body in both directions with equal effect, or of performing up stroke, as well as down stroke, scratching.

It is not always the second pedal digit only that takes over the functions of the toilet when the first is too valuable to be spared for this purpose. The second and third pedal digits may both be set aside for this function. In the true Lemurs the second pedal digit alone bears a claw, but in that Lemur, which is no Lemur—*Tarsius spectrum*—the second and third pedal digits are clawed, whilst all the rest have flat nails. Fortunately we have accurate observations upon the use of these toilet digits of *Tarsius*. (See Figure 15.)

Figure 15.—The pes of *Tarsius spectrum*, to show the second and third pedal digits, which both bear claws.

It is also the second and third pedal digits that are involved in that most interesting of all digital toilet implements—the conjoined pedal digits of the syndactylous marsupials. In 1839 Sir Richard Owen wrote of these peculiar little toes that "they look like little appendages at the inner "side of the foot for the purpose of scratching the skin and "dressing the fur, to which offices they are exclusively de- "signed." (13) No better statement could be made con-

(13) In Robert Todd's *Cyclopedia of Anatomy and Physiology*, 1839-1847, Art. Marsupialia, p. 286.

cerning their structure and function, nevertheless Owen's clear pronouncement—like so many of his dicta—has often been overlooked. We cannot pretend to approach any more nearly to accuracy by adopting Pocock's more recent

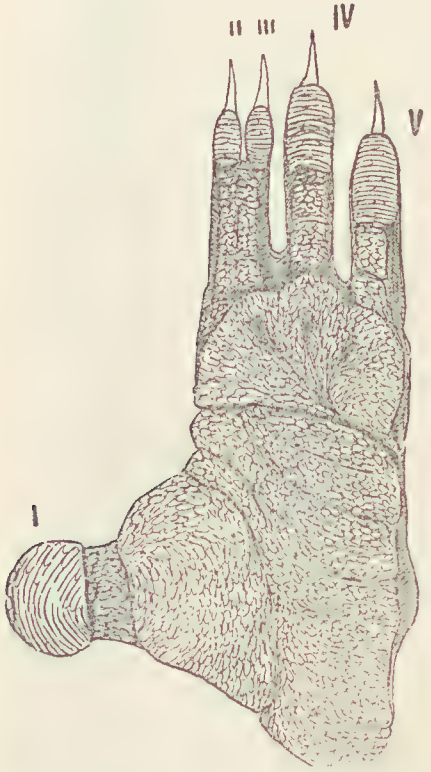

Figure 16.—The pes of the Native Bear (*Phascolarctus cinereus*), to show the elongated syndactylous second and third digits.

suggestions (14) that in *Phascolarctus* they are sufficiently well developed to assist in climbing, and in *Phascolomys* are large enough to be subservient to digging. It is enough to

(14) *Proc. Zool. Soc.*, 1921, Part III., p. 602.

know that they are used in the toilet and not in climbing or digging; that they are large enough to be used in either of these latter processes is a piece of information of no importance. That our hands are used for a variety of refinements of function is interesting, that they are large enough and strong enough to support the body weight in quadrupedal progression is no sound argument that their use lies this way. Pocock's reference to the function of the syndactylous elements of the Marsupial foot is added to this 1921 paper in the form of a footnote. In 1920 I had named the syndactylous digits as "toilet digits" in a paper dealing with the Common Opossum (*Trichosurus vulpecula*) (15), and at the time was unaware of Owen's previous dictum.

The correctness of this designation of them, and the truth of Owen's original assertion that to "these offices they "are exclusively designed" is confirmed by every observation that I have since made.

The syndactylous pedal digits of the Marsupials are definite hair combs, put to no other use whatever. They are not degenerate or rudimentary digits; they are highly specialised and highly functional members adapted to the single end of being fitted to comb the particular type of hairy covering possessed by the animal. Just as the toilet nail of *Echidna* varies in development with the growth of the spines, so these marsupials which possess long woolly or hairy coats have elongated syndactylous digits, whilst those with short coats have the elements far less developed. (See Figures 16 and 17.) We may contrast the elements in the long woolly coated Native Bear with those in the short smooth coated Red Kangaroo. Not only are they specialised toilet digits, but, as we have seen, there is reason to believe that they are begot when, in response to a change of diet, the many little sharp front teeth are replaced by few and larger chisel-shaped teeth. To those who have opportunities for watching Marsupials there is no need to dwell further on the matter. The wonderful mobility and aptitude of this little instrument are so easily observed in living animals that half an hour of observation will teach more than the reading of many books.

(15) *Trans. Roy. Soc. South Aust.*, Vol. XLIV., 1920, p. 372.

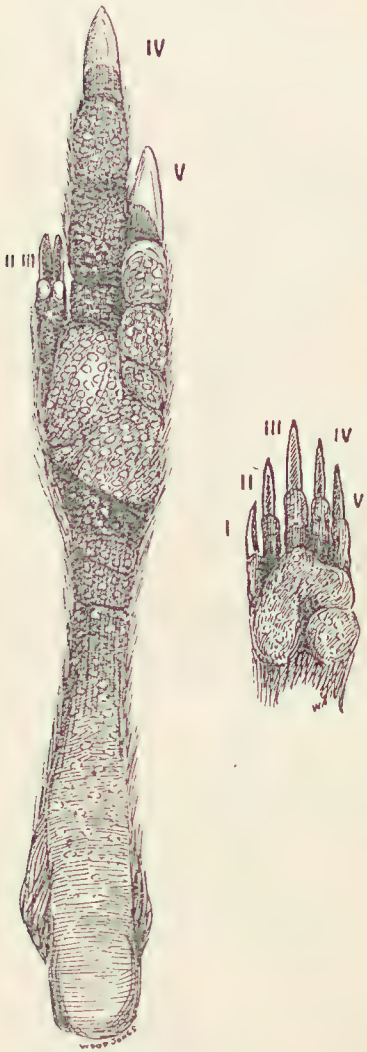

Figure 17.—The pes of the Dama Wallaby (*Thylogale eugenii*), to show the short syndactylous second and third digits.

MANUS SCRATCHING OR PES SCRATCHING.

With which member does any particular animal conduct its coat toilet? All of us have certain generalised pictures of animals scratching themselves; but it is astonishing how few printed records there are of the actual operation. We know that a dog scratches itself altogether with its pes; we know that a cat cleans certain parts of its body with its manus, others with the tongue directly, and that it seems to confine scratching with the pes to its "ticklish" spot at the base of the ears. We know that a monkey conducts the toilet of its whole body or the body of its neighbour with its fingers, and here let it be definitely laid down that a monkey's digital toilet is a pure skin and coat toilet, and is not, as is so commonly assumed, an unending pursuit of parasites. Monkeys are pre-eminent among the mammalia for being free of ecto-parasites. There is no such thing as a monkey flea or a monkey with fleas.

After prolonged investigations upon all the monkeys dying in the gardens of the Zoological Society of London, careful search for parasites proved vain until the arrival of a consignment of closely packed, ill-conditioned monkeys, that, during their long journey in overcrowded cases, had become infested with a *pediculus*. The ordinary monkey that is so assiduous in its toilet has no parasites to capture, and it will apply the process to a human hand and arm with as much zest as it displays in the case of its neighbour or itself.

In the case of that most interesting of the Primates—*Tarsius spectrum*—we have, thanks to Professor Le Gros Clarke, (16) an accurate description of the toilet, for he says:—"The hind limb is used for scratching purposes, the "digits of the pes being flexed on the sole in such a way that "only the two claws on the second and third digits are left "protruding." This animal also conducts its toilet with its tongue "by licking the fur after the manner of a cat." With the great majority of the higher animals we need more extensive study and a better recorded series of observations. One little detail may, however, be recorded. During the stay of a party on Pearson Island in January, 1922, all the members were much struck with the ability of the otarid Hair Seals to scratch themselves over a large area of the body with the nails of the pes, when the flipper membrane was flexed from the free extremities of the nails. The

(16) *Notes on the Living Tarsier, Proc. Zool. Soc. Lond.*, 1924, p. 219

toilet of these Sea Lions is conducted with the nails of the pes, and a long-continued and oft-repeated toilet it is. The interest of this toilet of the Seals lies in the fact that the phocid Seals are unable to conduct a pedal toilet, since their hind limbs are permanently turned backwards as the tail flipper. In the Phocids then, the limited toilet is conducted by the claws of the manus. This example of the toilet of the two divisions of the *Pinnipedia* is of interest, for it shows us that a vast number of observations must still be made and recorded upon the toilet methods of the higher mammals. In the case of the Monotremes and Marsupials we are on more certain grounds. I think that none will dispute the pedal toilet of the bristles conducted by *Echidna*; certainly no critics will arise from the ranks of those who have ever given room to this most difficultly housed and most tiresome of pets. With *Ornithorhynchus*, however, the case is very different. Dr. George Bennett made many observations on the toilet of the Platypus, and nowhere in his writings can I find any reference to the employment of the manus as a toilet implement. (17) In his numerous admirable accounts he always mentions the employment of the pes; he notes that the toilet of the coat is an oft-repeated affair, and he makes several references, of which the following may be taken as typical:—

(1) *Op. cit.*, p. 119. "In this process of cleansing the "skin the hind claws were brought into use—first the claws "of one hind leg, then those of the other; but finding that "it could not use the one to which the string was attached so "well as the other, which was disengaged, after repeated "trials it gave up the attempt. The body being so capable "of contraction, was readily brought within reach of the "hind feet, the head also coming in for its share of the pro-"cess." (2) On page 143 he records that they "reclined on "one side, scratching themselves with the hind claws." (3) He also noted, p. 135, that, "besides combing their fur to "clean it when wet, I have seen them preen it with their "beak (if the term may be allowed) as a duck would clean "its feathers."

Dr. Bennett, we may therefore conclude, noted that the coat toilet was conducted with the pes, aided by the occasional preening with the "beak." That the coat toilet should be conducted by the pes we would expect from the anatomical

(17) *Gatherings of a Naturalist in Australia*, London, 1860.

conditions displayed in the manus and pes respectively, and also from a general knowledge of the use of the pes and manus in early mammalian forms.

Of late, however, a disturbing note has crept in, for Mr. Harry Burrell (18) has declared for the manus toilet of the Platypus. In that paper he says:—"Having studied "the Platypus in captivity as well as in its natural haunts. "I am convinced that most of the principal duties are per- "formed with its active and powerful fore-limbs" . . . . "in grooming or scratching itself, this quaint contortionist "squats 'tripod fashion' on its haunches, and imitates every "antic peculiar to a flea-infested monkey."

It must be remembered that Burrell is here attempting to establish the thesis that the soft, rubber-like hands "are "used for manipulating the eggs." It is possible that they are. But are the "soft, rubber-like hands" used for the toilet of the fur, as he describes, to the exclusion of the better adapted pes, as Bennett maintained? It can only be said that anatomical probability supports Bennett's observations, but that wider and more extended observations are needed to settle the point. Meanwhile, we may safely affirm that when Burrell likens the Platypus to a "flea- "infested monkey" he may be making genuine and astute observations on the Monotreme, but he does less than justice to the Primates. It must not be forgotten in this connection that even the spur of *Ornithorhynchus* has been deemed a toilet implement.

Of the *Didelphia*, I have watched many species at their toilet. Of the Didactylous forms, all the species that I have had under observation, including various Pouched Mice and Native Cats, have conducted the coat toilet with the pes, aided by the teeth. All scratching is done with the foot, and the manus is never employed in this occupation. With the *Syndactyla* the methods vary. I have had several members of the *Peramelidæ* living in captivity, and all of them, from the Short-nosed Bandicoots (*Isoodon*) to the Bilbies (*Thalacomys*), employ the pes only, aided by an occasional nibble with the front teeth. So great is their reliance on the pes for the performance of the coat toilet that one Bilby (*Thalacomys nigripes*), which lived for long in captivity and had suffered the loss of a hind leg in a steel rabbit trap, made vigorous efforts to scratch with its stump, but never

(18) *The Australian Zoologist*, Vol. I., Part 4, 1917, p. 87.

replaced the office of the absent pes by attempting to employ the manus. Most of the *Phalangeridæ* employ the pes for the regular coat toilet, but in many of them the manus has a limited and occasional use over a restricted area of the body. The members of the *Macropodidæ* vary in their usage. The only member of the *Potoroînæ* that I have had under observation is *Bettongia lesueuri grayi*, and this animal I have never caught employing the manus in its toilet. Many examples of this species I have had under observation in captivity for several years, but since they are nocturnal in their activities they are not easy to study. Nevertheless, as the pedal toilet has been witnessed on many occasions, it is safe to say that if the manus is used for this purpose at all its employment is no regular thing. Among the *Macropodinæ* there is also a difference in individual methods, for though the manus toilet is only a very occasional affair in the little Wallabies of the Dama group, it is a constant and regular proceeding with some of the larger Wallabies and with all the Kangaroos that I have observed. In all the Kangaroos the manus and the pes are employed each for its special office in the toilet, and herein lies the interest in the study of these animals.

It is much to be hoped that all field naturalists who have opportunities for observing animals at their toilets will record their observations, for so many intimate details are lacking in our knowledge of these habits of even the commonest animals.

THE SPECIAL NEED FOR TOILET APPLIANCES IN CERTAIN ANIMALS.

We have seen, even within the limits of this very partial survey, that whereas some animals possess well defined toilet appliances, some are apparently not so well endowed. It may be asked, why are some animals so lavishly supplied whilst others apparently go lacking? In the first place we may be fairly sure of our ground when we assert that if an animal retains fairly generalised digits such as are possessed by the higher Primates, toilet appliances will be few. The nimble, resourceful, inquisitive fingers have supplanted the specialised toilet implements.

But suppose the digits become so altered that they are useless for the performance of the toilet, then there is need for specialisation. This is the case with the Bats, and in

lesser degree, with the Flying Lemur, which, as we have seen, possess such cunningly contrived toilet appliances.

Into this category fall most of the *Ungulata*, and in them there seems to be but little provision made to compensate for the loss of the individual digits. *Ungulata* must use their tails, their horns, even their hoofs, and over certain areas their tongues. They must rub against external objects, roll in herbage, wallow in the mud, or, in extremities, resort to a bath.

Then, again, the texture of the coat has to be considered; and here the *Ungulates* are compensated by nature, for most of them have coats which do not require an elaborate toilet, and some are practically naked. Nevertheless we may note here that when, by artificial selection, man develops an abnormally thick coat, which requires a toilet, on an *Ungulate* that cannot conduct the toilet, disaster is likely to occur. We rightly blame the blow fly for the havoc it plays among sheep; but we must not overlook the fact that we have developed for commercial purposes a coat which needs a toilet on an animal which is incapable of carrying out the toilet. Another consideration is also of importance. Just as, according to the anonymous writer of 1724, our finger nails were provided as weapons against the small creatures which pestered us, so are the toilet digits of the mammals adjusted to their prevalent ecto-parasites. Osborn noted in connection with the toilet of the Jamaican *Nyctinomus* that "probably the "numerous Bat-flies with which they are infested may be "the cause of extra dressing." These ecto-parasites of the Bats are peculiar creatures and the *Nycteribiidæ* infesting Australian bats have recently been reviewed by Musgrave, of Sydney. (19)

I have elsewhere alluded to the importance of the Marsupial parasites known as *Mallophaga* or Biting lice. (20) These parasites have been studied by Launcelot Harrison and Harvey Johnston, (21) and their presence in the coats of the Marsupials possibly accounts for the need of the elaborate Marsupial toilet. The study of Mammalian ecto-parasites and mammalian toilet mechanisms is one which stands in need of correlation. But it is not to be doubted that the parasite is to be considered in the question.

(19) *Records of the Australian Museum*, Vol. XIV., No. 4, 1925, p. 289.
(20) *The Mammals of South Australia*, 1924, p. 135.
(21) *Parasitology*, Vol. VIII., No. 3, 1916, p. 338.

THE MAMMALIAN COAT.

So much for some of the numerous ways in which the mammals conduct the toilet of the coat, and for some of the factors which demand the creation, and determine the type, of the special toilet implements.

It is necessary, as a further step in this study, to examine what may be described as a typical mammalian coat. For this purpose we may select a primitive member of the *Didelphia* and Krefft's Pouched Mouse (*Dasycercus cristicauda*) provides an admirable example of such an animal. (See Figure 18.) In the adult animal the fine

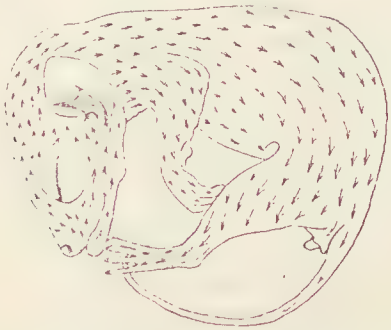

Figure 18.—Pouch young of Krefft's Pouched Mouse (*Dasycercus cristicauda*), to show the primitive type of hair tracts.

soft hair lies smoothly all over the body, and the tips of the hairs are all directed backwards, so that the animal can be stroked from head to tail in order to smooth its hair. We can learn more when we examine an immature young animal upon which the hair is only just beginning to appear. In such a specimen the direction of the short hairs is readily detected, since each individual hair is short and stiff, and is like a nail driven obliquely into a piece of wood. The hair is not yet long enough to have its direction altered by brushing or parting.

It must be insisted here that the study of hair direction can only be undertaken properly upon such young animals, and that it is much to be desired that hair charts of suitable specimens should always be recorded. Accounts based on the examination of living adults may also attain to a high degree of accuracy, but descriptions written from skins or from prepared or mounted specimens are likely to be extremely misleading.

In *Dasycercus* the hairs of the muzzle and chin point directly backwards, and those of the face, running to the anterior angle of the eye, part into two slightly curved streams, which run around the eye and meet again at the front of the ear. Upon the head and neck, the chest, and the whole of the back, sides, and ventral surface of the body the hairs are pointed with their free tips directed backwards and slightly downwards. Along the tail the hairs follow the same direction, pointing to the tip. Upon the backs of the ears the hairs stream from the sides of the head, and are directed towards the tip of the auricle. On the limbs, the hairs point downwards from the body to the digits and also backwards from the front (pre-axial) aspect of the limb to its hinder (post-axial) aspect.

This may be taken as the picture of the primitive hair pattern of the mammal, and it may be summed up by saying that the hair is directed caudad and ventrad upon the trunk and distally and post-axially upon the limbs. Among the primitive Marsupials that present this simple type of hair pattern we may mention the Banded Ant Eater (*Myrmecobius fasciatus*), the Native Cats (*Dasyurus*), and the Tasmanian Devil (*Sarcophilus*), as well as the little Pouched Mice, of which we have taken *Dasycercus* as an example.

Besides these marsupial animals, the primitive hair pattern may be seen in a large number of less specialised higher mammals. But the primitive hair pattern is upset in some way or another in many types, and these upsets lead to the development of the well-known hair tracts.

HAIR TRACTS AND THEIR CAUSATION.

It is well known that whilst some animals have a uniformly directed hairy coat, others show partings, whorls, convergences, and reversals in certain areas of their bodies. Everyone is familiar with these things upon the coats of domestic animals or even the poorer manifestation of them, upon the hairy covering of man himself.

Why is the hair of some animals arranged in the pattern of basal mammalian simplicity, and how are any alterations in this basal simplicity effected in those animals showing departures from the primitive mammalian type? At once we encounter theories, and many such have been put forward to account for the varying hair trend in the mammals.

When once the hair trend has been altered from the primitive caudad, post-axial, direction, many factors might possibly be invoked to account for this alteration. We may summarise those that have been suggested as follows:—

Schwalbe, who studied the question exhaustively, postulated that, for the most part, body contour and the stretching of skin during growth accounted for the disposition of the hair. Voigt had previously put forward very much the same explanation; for he imagined that the course which the enlargement of the body takes, in the early stages of development, produced that stretching of the skin which caused the hairs to slope in different directions. Eschricht believed that the alteration of hair pattern depended upon the distribution of the vascular system. Thompson, who looked at the matter from an altogether different angle, broke fresh ground when he postulated a functional cause in the necessity for offering the least resistance to the air, to grass, brushwood, and other obstacles through which the adult animal moved. It was Thompson who also enunciated the watershed theory which found expression in the work of Darwin and subsequently of Leonard Hill. Dr. Walter Kidd followed Thompson in the upholding of external causes, these external causes being gravity, posture, movement, and the habits of the animal. (22)

Lastly, in 1924, Bolk, of Amsterdam (23), rejected all the findings of Kidd, and returned to the internal causation, which he imagines rather vaguely to be "certain conditions "of the growth of the skin." It is difficult, at first sight, to understand why the very simple explanation put forward, for some cases by Thompson and for others by Kidd, did not at once gain practically universal acceptance. Any one, who is an observer of living animals, could appreciate the fitness of the explanation when applied to certain hair tracts, no matter if its correctness did not seem to be revealed by all. On the other hand, even the advocates of the contour, stretching, and growth theories do not appear to have a clear notion of the actual production of any individual hair tract, and, for one who is not an advocate, it is a difficult matter to picture the processes involved.

When the primitive hair trend is upset, it may merely be modified or slightly distorted, obviously by the dictates of the proportions and contours of the body; or it may be completely reversed.

(22) *Initiative in Evolution*, 1920.

(23) *Journal of Anatomy*, Vol. LVIII., Part iii., p. 206.

It is those cases in which there is a complete reversal of hair trend that are most likely to reveal the causation, since, in order to turn the hair stream into a direction directly opposite from that which is primitive, the causal factor must be potent and probably the more easily discernible. In studying these reversals we will mainly confine our attentions to the Marsupials, since in them our opportunities for observation are so much more extensive and our conclusions the more easily checked.

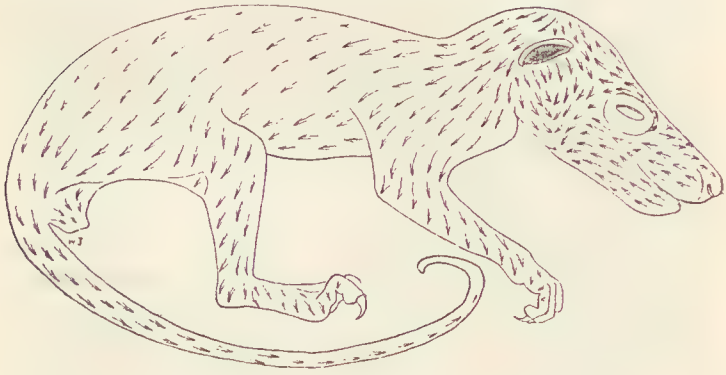

Figure 19.—Pouch young of the Rock Opossum (*Pseudochirops dahli*), showing pes reversal on the side of the head, and the preocular reversal in front of the eye.

The first striking reversal of hair trend to be noted in the Diprotodonts is that tract which involves, as a rule, the vertex of the head, the forehead, and sides of the face. A simple example of this may be taken from *Pseudochirus* or *Trichosurus*. As seen in these animals, the reversal area starts at a whorl situated somewhere on the crown of the head and, from the whorl, the hair radiates (1) straight forwards along the forehead, (2) downwards and forwards to the posterior angle of the eye, (3) directly outwards to the dorsum and posterior surface of the large ears, and, at its hinder limit, becomes normal by merging with the unreversed nuchal stream.

The making of this area I have watched repeatedly, and, from the experience thus gained, have no hesitation in affirming it to be caused by the scratching of this region, in a direction reversed from the normal hair trend, by the syndactylous toilet digits of the pes.

If *Trichosurus* be watched at its toilet it will be seen that, when it scratches itself with its hind limb, the syndactylous hair comb is raised to the anterior part of the body and the hair comb comes in contact with the animal's vertex in the neighbourhood of the whorl. From this point, at which it starts its work, it scratches the hair forwards to the forehead, forwards and downwards to the eye, and outwards on the ears. The anterior limit of this reversed tract marks the forwards sweep of the syndactylous digits as they pass down the face behind the eye. This reversed tract, made by the forward combing of the pedal syndactylous digits, I have termed the *main area of pedal reversal.* Now it is manifest that this area, if caused by pedal reversed scratching, would be liable to some variety in its exact position; for, depending upon the relative proportions of the hind limb and the trunk, there will probably be a variation in the exact area of the body accessible to pedal scratching.

In most Marsupials the caudad limit of the area is in the neighbourhood of the vertex; it may, however, extend back to the occiput, to the nuchal region, or even (in *Phascolarctus*) to the scapular region. (See Figures 20 and 21.)

Figure 20.—Pouch young of the Native Bear (*Phascolarctus cinereus*), showing pes reversal, I.-II., and manus reversal, III.-IV.

In *Phascolarctus* the area is extremely large, and it extends from a whorl situated in the middle line of the back over the shoulders, to the crown of the head just anterior to the ears. In all the species that I have examined, so far, the area takes caudad origin in a single middle-line whorl. In

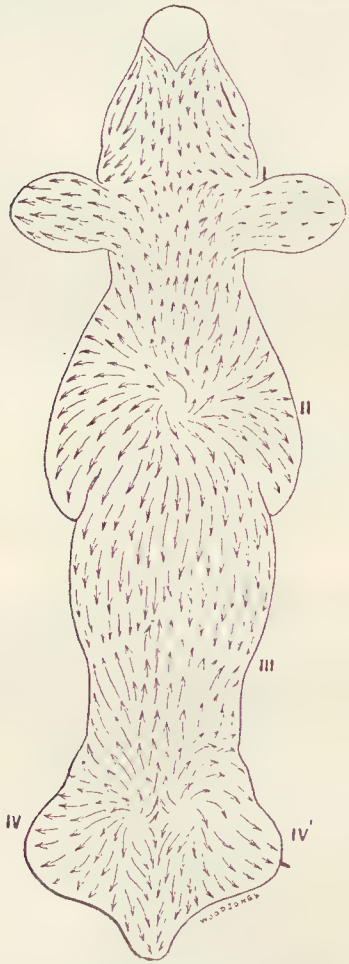

Figure 21.—Dorsal view of young Native Bear (*Phascolarctus cinereus*), showing pes reversal, I.-II., and manus reversal, III.-IV.

addition to this main pedal reversal there is a smaller and less constant reversal area, which is almost certainly caused by the reversed scratching of the syndactylous pedal digits. This area is situated upon the muzzle in front of the eyes, and is best termed the *pre-ocular reversal.*

So far as I know, no animal, in scratching its head and face, includes the actual area of the eye in its field of operations. The eye is avoided, and the combing digits pass downwards from the crown and ears behind the posterior canthus of the eye, to start operations again between the anterior canthus and the rhinarium.

Regarded in this way the pre-ocular muzzle reversal and the main pedal reversal may be regarded as being constituent parts of a single field interrupted by the presence of the eye. The pre-ocular reversal has been noted, so far, only among the *Phalangeridæ*, and it is well developed in *Pseudochirus* and in *Trichosurus*, but is not present in *Phascolarctus*.

In addition to scratching with the specialised digits of the pes, many Marsupials systematically scratch their coats with the digits of the manus. This habit is especially well marked in the *Macropodidæ*, but it is also typical of *Phascolarctus*, and probably of other Marsupials not yet studied.

In the business of conducting the coat toilet by the manus, a fairly wide area of the body may be subjected to scratching without there being any tendency to reverse the direction of the hair trend. There are certain areas of the body, however, where scratching by the manus is definitely done in a manner to cause hair reversal. One such area, which I have termed the *main area of manus reversal*, is of particular interest.

This area, like the main area of pedal reversal, is subject to some variation in its actual position, since its site naturally depends upon the relative proportions of the body and the fore limb. In *Phascolarctus* it is extensive, and it starts low down upon the lumbo-sacral region as two bilateral whorls situated close together upon either side of the middle line. From these whorls the hair streams forwards upon the dorsal surface in a direction completely reversed from the normal. The reversed field terminates in front at a convergent hair line, situated in the lower costal region, which extends farthest forward in the mid line and passes down the flanks with a caudad trend to reach the ventral surface in the flexure of the groin.

The stream lines from the lumbo-sacral whorls pass downwards and forwards at the anterior limit of the area, and downwards and backwards, merging with the normal stream at the hinder extremity. This is the area which is

scratched in a forward direction by the strong claws of the Koala, and it represents the normal reach of the manus in scratching the coat in a reversed direction.

In *Wallabia* (*Macropus*) *greyi* the main area of manus reversal is situated nearer to the anterior end of the body, since the short arms have a more limited reach in performing the action of reversed scratching. (See Figures 22 and 23.)

Figure 22.—Pouch young of the Toolache (*Wallabia greyi*), showing pes reversal, I.-II., manus reversal, III.-IV., and ventral manus reversal, V.-VI.

In this animal the start of the area is again in bilateral whorls, which, instead of being situated over the lumbo-sacral region, are shifted forward to the lower costal region. From

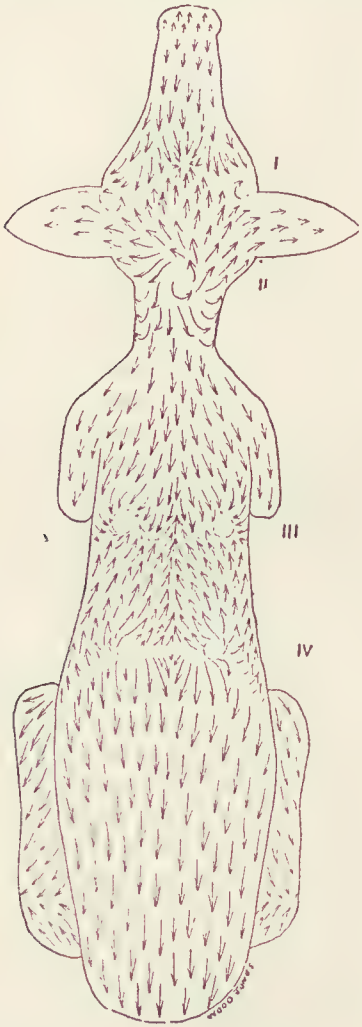

Figure 23.—Dorsal view of young Toolache (*Wallabia greyi*), showing pes reversal, I.-II., and manus reversal, III.-IV.

these whorls the reversed area runs forward and terminates at a convergent and whorled line over the scapular region. It is interesting to note, that, whereas the main area of pedal

reversal starts at a single mid line whorl, the main area of manus reversal starts, in these types at least, in bilateral whorls.

In *Wallabia greyi* and in the Kangaroos, there is another area of manus reversal upon the ventral surface of the body, extending over the perineal and lower abdominal region. This area I have termed the *ventral manus reversal area.* Now the designation of these reversed fields as areas of manus and pes scratching is no mere matter of abstract nomenclature; for this manus and pes scratching in a direction reversed from the normal hair trend is the hall-mark of the animals under consideration.

The coincidence of reversed scratching by manus and pes with the areas of hair reversal is a thing which may be witnessed constantly during observation of the living animal. There is still another reversal present in many Marsupials (as well as in many Monodelphians), which I have termed elsewhere the *rhinal reversal area.*

This area involves the very fine hairs situated just above and behind the naked rhinarium. From watching *Trichosurus*, I have come to the conclusion that this reversal is created by the forward licking of the area by the tongue. Many animals sweep the tongue around their mouths—lick their chaps—at the completion of a meal; and, in this licking, the area immediately behind the rhinarium tends to be reversed. This action is well seen in the domestic cat, in which animal the rhinal reversal is particularly well displayed. I have, therefore, come to the conclusion, from observations on living animals, that the rhinal reversal is a licking reversal. I have suggested elsewhere (24) that the well-known groin reversal of horses is in reality caused by the upward licking at that part of the body which a horse can reach with its tongue. To this point it is to be hoped that those in constant association with horses would direct attention.

If these hair tracts of mammals have every appearance of being caused by the method of the coat toilet, it may well be asked if the hair of our scalps, subjected for so long to the attentions of our artificial toilet implements, shows the development of hair tracts that might be correlated with the use of these implements. In 1901 Dr. Walter Kidd wrote

(24) *Journal of Anatomy*, Vol. LIX., Part I., p. 76.

an admirable paper on the hair tracts of man (25), and in it he pointed out the high probability that the human scalp hair pattern was "due to the inherited effect through "numerous generations of the method adopted in dressing the "hair." Although Professor Bolk (*op. cit.*) has since opposed those views he has substituted no sufficient alternative factor. In a later paper (26) I have pointed out further evidence in favour of Dr. Kidd's hypothesis, and likened the human scalp reversals to those noted in the *Phalangeridæ*. In that paper the question is summarised as follows:—"In the case "of *Pseudochirus*, the area is a pes reversal, for it is made "by the use of the syndactylous toilet digits of the pes. Of "that I think there is no doubt whatever. In the case of man, "I regard it, with Kidd, as a manus reversal, being made by "the artificial toilet appliances used in the hands. Let "anyone scratch his head in idleness and see if the fingers "do not naturally encounter the whorl, and then traverse the "stream lines forwards to the forehead, sideways to the ears, "and backwards to the nape. *Pseudochirus*, with its pedal "hair comb, carries the reversal further back than man does; "but for the rest the cause and effect are similar." For myself, I believe that the casual formation of hair tracts by brushing and scratching may be extended in the human body beyond the scalp area. Indeed, just as I would recommend anyone desirous of understanding mammalian hair tracts to watch the animals at their toilet, so would I recommend the student of human anatomy to watch a man brush his hair, scratch his body, and brush his clothes.

Now, though I think it is perfectly fair to state that no one who watched a living Marsupial and compared its actions with a chart of its hair trend could fail to see that the habitual actions of the animal coincided, in a remarkable manner, with the distribution of its hair reversals, it must be remembered that in assigning habitual actions as the *causation* of hair trends, a far-reaching implication is involved.

It is this implication—that an oft-repeated external action produces hair reversals—that has probably led to the general non-acceptance of the conclusions of Thompson and of Kidd. And yet I can see no escape from accepting these conclusions. It is inconceivable to me that internal factors, such as growth and stretching of the skin, could determine

(25) *Proceedings of Anatomical Society*, 1901, p. xxx.
(26) *Journal of Anatomy*, Vol. LIX., p. 80.

the reversals in the embryo, and that then the adult animals should scratch or perform movements which would coincide with these reversals.

I am quite convinced, from my experience of observing living Marsupials, that it is the habitual actions of the animal that determine the causation of those hair trends that I have described. But here we are faced with a difficulty. An apparently trivial, habitual, action of the animal determines the disposition of its hair tracts; but these hair tracts are already fully determined in the embryo as soon as ever its hair appears, and long before it has performed any of its habitual actions. It would be idle for anyone to deny that the alteration of the hair trend by scratching was anything other than a trivial acquired character, begot during the lifetime of the adult; a character stamped on the animal from the repeated performance of a trivial action. And yet we see that, in the embryo, the effects of this habit are visible in the hair tracts as soon as ever these are determined in the developing hair, and long before the young animal has started to rehearse any of its inherited habits.

It is difficult to understand how these hair tracts of the Marsupials can be construed as anything other than as instances of the inheritance of an acquired character.

Almost certainly it is the Lamarckian import of Kidd's work that has caused it to be adversely criticised, and which has led Bolk back again into the vagueness of expressions concerning the internal factor of the growth of the skin.

The ultimate implication of any explanation of a natural phenomenon must, of course, be borne in mind; but, if the explanation seems to be the true one, then we should consider well before we reject it, even though its acceptance imperils certain cherished beliefs.

It may be that to-day we are over given to estimating the value of facts by measuring them as items that do, or do not, fulfil the demands of existing theories. The day of true science will not dawn until we measure our existing theories by the metre of known facts. When it is appreciated that no single, well-established fact can be rightly disregarded, but that a dozen theories may be relegated to the scrap heap any day, without loss to science—then will science reign.

NOTES ON SOME TASMANIAN MESOZOIC PLANTS.

Part II.

By

A. B. Walkom, D.Sc.,

Secretary, Linnean Society of New South Wales.

Plate IX.

(Read 13th July, 1925.)

This paper completes the examination, undertaken last year, of a series of fossil plants from the Mesozoic Rocks of Tasmania. In addition to the collections of the Tasmanian Museum and Geological Survey, I have also had the opportunity of examining a small collection from Mt. Nicholas, presented by Mr. Alex. Montgomery to the Geological Survey of New South Wales. For this latter opportunity I have to thank Mr. W. S. Dun, who very kindly gave me his notes on the specimens, and also furnished me with the photograph of the specimen of *Pecopteris* figured here.

I take this further opportunity of reiterating my admiration of the work the late R. M. Johnston did on these fossil floras, thirty to forty years ago; and also of expressing again my appreciation of the kindness of Messrs. Clive Lord and P. B. Nye in giving me the opportunity of examining the collections and in offering every facility to assist me in the work.

The following list of thirty-three species indicates the extent to which the Tasmanian Mesozoic flora is now known, and compares favourably, as regards number of known species, with any of the floras of Mesozoic age in Australia:—

Equisctales:

Neocalamites Carrerei, Zeiller.
Phyllotheca australis, Brongn.

Filicales:

Cladophlebis australis (Morris).
„ *tasmanica* (Johnston).
„ *Johnstoni*, Walkom.
? *Phlebopteris alethopteroides*, Eth. Jr.

Thinnfeldia Feistmanteli, Johnston.
„ *odontopteroides* (Morris).
„ *lancifolia* (Morris).
„ *acuta*, Walkom.
„ cf. *talbragarensis*, Walkom.
Johnstonia coriacea (Johnston).
„ *dentata*, Walkom.
„ *trilobita* (Johnston).
Linguifolium diemenense, Walkom.
„ *Lillieanum*, Arber.
Sphenopteris Morrisiana, Johnston.
Pecopteris (cf. *Hillæ*, Walkom).
Tæniopteris Morrisiana, Johnston.
„ *Carruthersi*, Tenison-Woods.
Sagenopteris moribunda, Johnston.
Chiropteris tasmanica, Walkom.

Cycadophyta:
Pterophyllum Strahani, Johnston.
„ *risdonensis*, Johnston.
„ (*Anomozamites*) *inconstans* (Braun).
Pseudoctenis sp.
Sphenozamites Feistmantelii, Johnston.

Ginkgoales:
Ginkgoites digitata (Brongn.).
„ *salisburioides* (Johnston).
Baiera tenuifolia, Johnston.
? *Baiera bidens*, Tenison-Woods.
? *Czekanowskia* sp.
Phœnicopsis elongatus.

Neocalamites Carrerei has been recorded from rocks of Rhætic age in Tonkin and South Africa, and from the Ipswich Series, of Upper Triassic age, in Queensland.

Phyllotheca australis is more typically a Permian species, occurring in association with the Glossopteris flora. It is present in the Triassic Narrabeen Stage of the Hawkesbury Series in New South Wales, and has been recorded, with some doubt, from the Ipswich Series of Queensland.

Cladophlebis australis is of very widespread occurrence in Australia and New Zealand, as well as other parts of the world, in rocks of Triassic, Jurassic, and Cretaceous ages, and affords no indication of the exact horizon of the rocks in which it occurs.

Cladophlebis tasmanica and *C. Johnstoni* are so far only known from Tasmania.

Phlebopteris alethopteroides, described from rocks of the Walloon Series (Jurassic) in Queensland, was compared with the European *Phlebopteris polypodioides*, which is now placed in the genus *Laccopteris*. This latter genus is widely spread in Rhætic, Jurassic, and Lower Cretaceous floras, but up to the present the Australian species has only been found in Jurassic rocks.

Thinnfeldia. The distribution of this genus in Australia is of interest. It has been pointed out that in Queensland there are no records of *Thinnfeldia* from the Walloon Series, all the known occurrences being in the Ipswich Series or its equivalents. In New South Wales, however, although *Thinnfeldia* is abundant in the Triassic floras, it is also present in the Talbragar beds in association with *Taeniopteris spatulata*; these Talbragar beds are indicated to be of Jurassic age, both by their stratigraphical relations and by their fossil flora. In New Zealand, *T. Feistmanteli* occurs in ? Rhætic and also in Middle Jurassic rocks; *T. lancifolia* and *T. odontopteroides* only in rocks of Rhætic age. In Tasmania there are five species of *Thinnfeldia*, four of which (*Feistmanteli, odontopteroides, lancifolia*, and *acuta*) occur in the Ipswich Series of Queensland, or its equivalents (Rhætic, or a little older), and the fifth (cf. *talbragarensis*) is a species intermediate between *Feistmanteli* and *lancifolia*, which was described from the Jurassic Talbragar Beds.

The genus *Johnstonia* is not known outside of Tasmania, and the three species included in it cannot yet be used for purposes of correlation.

Linguifolium Lillieanum is a species described by Arber from rocks of Rhætic and ? Lower Jurassic age in New Zealand, but has not hitherto been recorded from Australia. *L. diemenense* is only known from Tasmania.

Sphenopteris Morrisiana is also a species known only from Tasmania.

The specimens compared with *Pecopteris Hillæ* would, if the comparison were certain, be of some value in correlating the Tasmanian strata with those of the mainland. Both sterile and fertile fronds of *P. Hillæ* have been described from the Esk Series (equivalents of the Ipswich Series) in Queensland, of Upper Triassic age.

Tæniopteris Morrisiana is only known from Tasmania; *T. Carruthersi* (= *T. tasmanica*, Johnston) occurs in the Ipswich and Esk Series in Queensland.

Species of *Sagenopteris* are not of common occurrence in Australia, and, so far, all the specimens have been referred to one species, and have been obtained from Jurassic rocks. The species *S. moribunda* from Tasmania may possibly be synonymous with *S. rhoifolia* of the mainland.

Chiropteris tasmanica appears to differ from *C. lacerata*, the only other species known from Australia or New Zealand, which occurs in the Rhætic Beds at Mount Potts, New Zealand.

Pterophyllum Strahani and *P. risdonensis* are only known from Tasmania. *P.* (*Anomozamites*) *inconstans* is referred to a species which occurs widely in rocks of Rhætic age.

Sphenozamites Feistmantelii is only known from Tasmania.

Ginkgoites digitata is a very widespread Jurassic species, and specimens referred to it have been obtained from the Ipswich and Esk Series in Queensland. A similar form is *G. moltenensis* from the Rhætic of South Africa.

Ginkgoites salisburioides cannot at present be correlated with any species occurring in other localities. The small rosette-shaped structures found in association with *Baiera tenuifolia* are similar to those described from the Ipswich Series in Queensland, and also from the Stormberg Beds in South Africa, as *Stachyopitys annularioides*.

Baiera bidens, a common Jurassic type, occurs in the Ipswich Series in Queensland, and *B. australis*, a similar form, is found in the Jurassic of Victoria.

The type of leaf described as *Phœnicopsis elongatus* is common in the Esk Series of Queensland, and also occurs in the Stormberg Beds of South Africa, both of Rhætic age. Similar leaves have been described from Rhætic rocks in South America.

Of this list of thirty-three species there are seventeen which are known definitely to occur in other Mesozoic floras.

The following table indicates which of these seventeen species are also found in other Australian Mesozoic floras:—

	Narrabeen Beds, N.S.W. (L. Trias.)	Ipswich and Esk Series, Q'land (Rhætic).	Rhætic of New Zealand.	Walloon Series, Q'land (Jurassic).	Talbragar Series, N.S.W (Jurassic).	Jurassic of New Zealand.	Jurassic of Victoria.
Neocalamites Carrerei		x					
Phyllotheca australis	x	x					
Cladophlebis australis		x	x	x	x	x	x
Phlebopteris alethopteroides				x			
Thinnfeldia Feistmanteli	x	x	?		x	?	
„ *odontopteroides*		x	x				
„ *lancifolia*	x	x	x				
„ *acuta*		x					
„ *talbragarensis*					x		
Linguifolium Lillieanum			x			x	
Pecopteris Hillae		x					
Taeniopteris Carruthersi		x					
Pterophyllum inconstans							
Ginkgoites digitata		x					
Baiera tenuifolia		x					
„ *bidens*		x					
Phoenicopsis elongatus		x					
	3	13	5	2	3	3	1

This shows thirteen of the seventeen species to be common to the Tasmanian flora, and that of the Ipswich and Esk Series of Queensland, and leaves no doubt that there is a much closer relation between these two floras as at present known than between the Tasmanian and any other flora in Australia and New Zealand.

It is notable that the only species common to this Tasmanian flora and the Victorian Jurassic flora is *Cladophlebis australis*, a species which is present in almost every Mesozoic flora known.

Perusal of the foregoing notes on the distribution of the species occurring in the Tasmanian Mesozoic flora gives strong support for the suggestion that the whole of the collections examined by me have been obtained from rocks of Upper

Triassic (Rhætic) age, and that these may be correlated as regards their age with the Ipswich Series (and its equivalents, the Esk Series, and probably also the Lower portion of the Tiaro Series) of Queensland, and the Rhætic beds occurring at Mount Potts and the Clent Hills (Canterbury).

As stated in the first part of this paper, very many of the specimens examined have been without locality labels, and it now remains for someone with a knowledge of the field geology of the rocks from which these fossils were collected to identify as many of the specimens as possible lithologically. I feel sure that correct localities could be determined in this way for more than 90 per cent. of the specimens.

Until this has been accomplished, little further can be done in correlating the fossil collections from different districts with one another, and with those obtained from the various Mesozoic strata of Australia and New Zealand.

REVISION OF THE DETERMINATIONS OF R. M. JOHNSTON AND O. FEISTMANTEL.

In view of the long period which has elapsed since R. M. Johnston and O. Feistmantel described collections of Tasmanian plants, and of the many changes in nomenclature since those days, it is considered that the following revision of the names applied to their figured specimens will be of considerable value and interest to students of Tasmanian fossil floras. Only the figured specimens have been dealt with, as one can feel reasonably certain of identification in these cases, whereas there would be too much uncertainty attached to a similar treatment of those species which were described but not figured.

R. M. Johnston. (Pap. Prop. Roy. Soc. Tas., 1886.)	Revised Nomenclature.
Pl. 1.	
1-1A *Pterophyllum Strahani*	= *Pterophyllum Strahani.*
2 *Salisburia hobartensis*	= ? *Baiera bidens.*
4-4A *Sagenopteris salisburioides*	= *Ginkgoites salisburioides.*
5-5A *Glossopteris moribunda*	= *Sagenopteris moribunda.*
Pl. 2.	
1 *Alethopteris serratifolia*	= *Cladophlebis australis.*
2 *Neuropteris tasmaniensis*	= ? *Thinnfeldia lancifolia.*
Pl. 3.	
1 *Cyclopteris australis*	= *Ginkgoites digitata.*
2 *Baiera tenuifolia*	= *Baiera tenuifolia.*
3 *Ginkgophyllum australis*	= ?
4 *Neuropteris antipoda*	= ? *Cladophlebis australis.*
5 *Odontopteris crispata*	= *Pterophyllum (Anomozamites) inconstans.*
6 *Pterophyllum (?) dubia*	= ? *Taeniopteris* sp.

Pl. 4.

1-2	*Sphenozamites Feistmantelli*	= *Sphenozamites Feistmantelii.*
3	*Taeniopteris tasmanica*	= ? *Taeniopteris Carruthersi.*
4	*Trichomanides Ettingshauseni*	= ?
5	*Thinnfeldia media*	= ? *Thinnfeldia lancifolia.*
6	*Thinnfeldia trilobita*	= *Johnstonia trilobita.*

R. M. Johnston.
Geology of Tasmania (1888).

Pl. 25.

1	*Pecopteris (Thinnfeldia) odontopteroides*	= *T. lancifolia.*
2	" " "	= *T. lancifolia.*
3	*Thinnfeldia* sp.	= *T. Feistmanteli.*
4	*Pecopteris (Thinnfeldia) odontopteroides*	= *T. lancifolia.*
5-6	*Alethopteris australis*	= *Cladophlebis australis.*
7	*Thinnfeldia obtusifolia*	= *T. odontopteroides.*
8	*Alethopteris australis*	= *Cladophlebis australis.*
9	*Thinnfeldia obtusifolia*	= *T. Feistmanteli.*
10	*Danaea Morriziana*	= ?
11	Fruit of a conifer	= ?
12	Seed	= ?
13	*Pecopteris caudata*	= ?
14	*Thinnfeldia obtusifolia*	= *T. odontopteroides.*

Pl. 26.

1	*Pecopteris caudata*	= ? *Linguifolium diemenense.*
2	" "	= ? *Johnstonia coriacea.*
3	Unnamed	= ?
4-5	*Thinnfeldia superba*	= *T. lancifolia.*
6	*Pecopteris caudata*	= ? *Thinnfeldia* sp.
7	*Thinnfeldia obtusifolia*	= ? *T. odontopteroides.*
8	*Pecopteris caudata*	= ? *Johnstonia coriacea.*
9	*Rhacophyllum coriaceum*	= *Johnstonia coriacea.*
10-11	? *Phyllotheca*	= ? *Baiera tenuifolia.*
12	*Thinnfeldia trilobita*	= *Johnstonia trilobita.*
13-14	? *Phyllotheca*	= ? *Baiera tenuifolia.*
15	*Thinnfeldia obtusifolia*	= ? *T. odontopteroides.*
16	Seed	= ?
17	*Thinnfeldia obtusifolia*	= ?
18	? *Phyllotheca*	= ? *Baiera tenuifolia.*
19	*Cyclopteris australis*	= ?
19a	*Baiera tenuifolia*	= ?
20	*Pecopteris caudata*	= ? *T. odontopteroides.*
21	*Thinnfeldia obtusifolia*	= *Thinnfeldia* sp.
22	cf. *Glossopteris Browniana*	= ? *Sagenopteris moribunda.*

In his "Geology of Tasmania," R. M. Johnston repeated the four plates from his paper in the Proceedings of the Royal Society of Tasmania for 1886 as follows:—Plates 1, 2, 3, and 4 = Plates 28, 23, 27, and 24 respectively of the Geology of Tasmania.

R. M. Johnston. (Pap. Proc. Roy. Soc. Tas., 1893.)	Revised Nomenclature.
Pl. 2., figs. 1-5.	
Pecopteris odontopteroides	= *Thinnfeldia lancifolia.*
(Pap. Proc. Roy. Soc. Tas., 1894-5.)	
Fig.	
1 *Neuropteris tasmaniensis*	= ? *Thinnfeldia lancifolia.*
2 *Thinnfeldia Feistmantelli*	= *T. Feistmanteli.*
3 *Pecopteris Buftoni*	= ? may be *T. lancifolia.*
4 *Pecopteris caudata*	= ?
5-7 *Strzeleckia gangamopteroides*	= ? *Linguifolium diemenense*
8 „ *tenuifolia*	= ? *Johnstonia coriacea.*
9 *Cardiopteris tasmanica*	= ?
10-13 *Sphenopteris tasmanica*	= *Cladophlebis tasmanica.*
14-15 „ *Morrisiana*	= *S. Morrisiana.*
16 *Thinnfeldia polymorpha*	= ? *T. Feistmanteli.*
17 *Gleichenia dubia*	= ?
18 *Thinnfeldia Buftoni*	= ? *T. lancifolia.*

O. Feistmantel. Uhlonosne Utvary v. Tasmanii, 1890. Prague.	Revised Nomenclature.
Pl. 7.	
3-5 *Thinnfeldia odontopteroides*	= *T. odontopteroides.*
6 *Alethopteris australis*	= *Cladophlebis australis.*
Pl. 8.	
*1 *Sphenopteris elongata*	= ? coniferous branch.
*2-4 *Sphenopteris elongata*	= ? *Baiera tenuifolia.*
*5 *Thinnfeldia odontopteroides*	= *T. odontopteroides.*
6-10 „ „	= „
*11 ? (*P. caudata*, R.M.J.)	= ?
*12 *Thinnfeldia trilobita*	= *Johnstonia trilobita.*
*13 *Thinnfeldia saligna*	= ? *Linguifolium diemenense.*
*14 *Taeniopteris Carruthersi*	= *Taeniopteris Carruthersi.*
15 *Alethopteris australis*	= *Cladophlebis australis.*
*16-17 *Glossopteris moribunda*	= *Sagenopteris moribunda.*
18-18a *Sagenopteris tasmanica.*	= ?
Pl. 9.	
*1-1a *Sagenopteris salisburioides*	= *Ginkgoites salisburioides.*
*2 *Nilssonia polymorpha*	= ? *Taeniopteris* sp.
*3 *Anomozamites inconstans*	= *Pterophyllum inconstans.*
4 *Podozamites elongatus*	= *Phoenicopsis elongatus.*
*5-6 *Sphenozamites Feistmantelii*	= *Sphenozamites Feistmantelii.*
7 *Otozamites Mandeslohi*	= †*Otozamites Mandeslohi.*
*8 Fragment of leaf	= ?
*9 *Gingko australis*	= *Ginkgoites digitata.*
Pl. 10.	
*1-2 *Anomozamites strahani*	= *Pterophyllum Strahani.*
*4-5 *Trichopitys Johnstoni*	= *Baiera tenuifolia.*
*6 *Gingko Hobartensis*	= ? *Baiera bidens.*

* Figures marked with an asterisk are exact or slightly modified reproductions of some of R. M. Johnston's figures.

† Although I have examined a large number of specimens from Tasmania, I have seen no trace of any species similar to this.

DESCRIPTION OF AND NOTES ON SOME OF THE SPECIES.

Thinnfeldia acuta, Walkom.

Qland. Geol. Survey, Pub. 257, 1917, p. 23, Pl. 3, fig. 4.

A single specimen of portion of a *Thinnfeldia* frond may be referred to this species. It has pinnules about 3.5 cm. long and 0.7 to 0.8 cm. wide at the widest part, and which taper gradually to an acute tip. The species was described from the Ipswich Series in Queensland.

Thinnfeldia sp. (cf. *T. talbragarensis*, Walkom).

A specimen similar to that figured by Johnston as *T. polymorpha* (Pap. Proc. Roy. Soc. Tas., 1895 (1896), p. 62, fig. 16) may be compared with *T. talbragarensis*, a species occupying a position intermediate between *T. lancifolia* and *T. Feistmanteli*, described from Talbragar, N.S.W. (Mem. Geol. Surv. N.S.W., Pal. No. 12, p. 9.)

Pecopteris sp. (? *P. Hillæ*, Walkom). (Plate IX., fig. 1.)

The specimen figured is one from Mount Nicholas, which shows little detail other than the form of the frond and a median vein in each ultimate segment. The general form and the size of the pinnæ and pinnules suggest a comparison with the sterile fronds of *Pecopteris* (*Asterotheca*) *Hillæ* described from Rhætic rocks in the Esk District of Queensland (see Mem. Q'land. Mus., viii., pt. 1, 1924, p. 82). A good specimen from the collection of the Geological Survey of New South Wales is figured on Plate IX., since no similar species has previously been figured from Tasmania.

Linguifolium Lillieanum, Arber.

Geol. Surv. N.Z., Pal. Bull. No. 6, 1917, p. 38.

A number of leaves in a small collection of plants from Mount Nicholas agree very closely with this species, described originally by Arber from New Zealand. Arber's description is:—"Leaves spathulate, up to 9 cm. or more in length, and "1.7-3 cm. across at their greatest width. Margins entire, "apex rounded, leaf gradually tapering to an elongate base; "midrib well marked, persisting to the apex. Lateral veins "arising at an acute angle to the midrib, arching upwards, "and then bending to the margin, once or twice forked, "about 1 mm. apart."

Associated with these larger leaves are numerous smaller ones, which only appear to differ in size, and for the present may be regarded as belonging to the same species. These

small examples are up to 6 cm. long and 0.5 cm. wide (though usually only 0.3 to 0.4 cm. wide), with a prominent midrib and secondary veins making an angle of 25deg.-30deg. with the midrib. The secondary veins usually branch once, and at the margin are about 1 mm. apart. I have only observed them associated with the larger ones.

Sagenopteris moribunda (R. M. Johnston).

Glossopteris moribunda, R. M. Johnston, Pap. Proc. Roy. Soc. Tas., 1886 (1887), p. 169, Pl. I., fig. 5; Feistmantel, Uhlonosne Utvary v. Tasmanii, 1890, p. 99, Pl. 8, f. 16 and 17.

The specimens referred to *Glossopteris moribunda* by Johnston were incomplete leaves, in which the anastomosing venation was the factor relied on for the reference to *Glossopteris*. The leaves would probably be more correctly placed in *Sagenopteris*, a Mesozoic genus with a similar type of venation. The network formed by the veins is somewhat more open than in the examples of *Sagenopteris* I have seen from Queensland, and probably the Tasmanian form is a different species. Feistmantel (1890, p. 99) suggested a reference to *Sagenopteris*, and for the present the best course would appear to be to keep the specific name proposed by Johnston, but to transfer it to the genus *Sagenopteris*.

Chiropteris tasmanica, n.sp. (Plate IX., fig. 2.)

Leaf fan-shaped, outer margin apparently lobed. Veins radiating from base, branching dichotomously, about 1 mm. apart; adjacent veins joining occasionally.

This single specimen could easily be taken, at first glance, for such a species as *Ginkgoites antarctica*, but closer examination shows that the veins occasionally anastomose, and there is some indication that the outer margin may be lobed, after the manner of some examples of *G. digitata*. The specimen is 3.5 cm. from base to outer margin, and about 3 cm. wide at its widest portion. It does not agree with Johnston's *Sagenopteris salisburioides* (= *Ginkgoites salisburioides*), and for the present may be placed in *Chiropteris*, a species of which has been described by Arber from rocks of Rhætic age in New Zealand. It is very similar to the fragment figured by Seward (Ann. S.Af. Mus., iv., Pt. 1, p. 62, Pl. ix., fig. 4) as *Chiropteris cuneata* from the Stormberg Beds (Rhætic) of South Africa.

(1) *Pecopteris* sp., from shales of Mt. Nicholas.
(2) *Chiropteris tasmanica*, n.sp.

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Pterophyllum (*Anomozamites*) *inconstans* (Braun.).

Odontopteris crispata, Johnston, Pap. Proc. Roy. Soc. Tas., 1886 (1887), p. 172, Pl. 3, fig. 5. *Anomozamites inconstans*, Feistmantel, Uhlonosne Utvary v. Tas., 1890, p. 108, Pl. 9, fig. 3.

The specimen placed by Johnston under *Odontopteris crispata* would seem to be more correctly placed under the division of *Pterophyllum*, in which the lamina is more or less continuous.

A somewhat similar type is *Nilssonia elegans*, Arber, described from rocks of Middle Jurassic age in New Zealand.

Sphenozamites Feistmantelii, Johnston.

The examination of additional specimens has convinced me that the best place for the specimen which, in Part I. of this paper, I referred to ? *Otozamites* is in *Sphenozamites*, where Johnston placed it in 1886. *Sphenozamites* was originally proposed as a subgenus of *Otozamites* for plants which agreed with this genus in venation and mode of attachment of the pinnæ, but in which the bases of the pinnæ were not auriculate. The additional specimens, which were amongst a later consignment forwarded me by the Geological Survey of Tasmania, show that the venation is that of *Otozamites*, *i.e.*, divergent and dichotomously branching, but that there is an absence of the characteristic lobe at the base of the pinna. It is difficult to determine the mode of attachment of the pinnæ to the rachis, but it does appear in places as if the pinna partly overlaps the rachis and is attached to the upper surface. There is in general a notable contraction towards the base of the pinna; there is also in all the specimens a number of the spine-like extensions of the lamina which are well shown in the figures. These peculiar extensions are generally traversed by a single vein, which, in cases where the extension of the lamina is itself forked, branch so that a single branch vein goes into each segment.

? *Czekanowskia* sp.

Associated with *Cladophlebis australis* at Mount Nicholas are numerous long, narrow leaves, suggestive in part of *Baiera tenuifolia*, but differing in that they are traversed by a series of delicate parallel veins or striations, and differing from that species also in an apparent absence of the branching which it commonly exhibits. Another suggestion

is that these may be leaves of an equisetaceous plant, *e.g.*, *Neocalamites Carrerei*, which has numerous long, narrow leaves at each node of the stem. The presence of a number of parallel veins, if such they be, is against this.

EXPLANATION OF PLATE IX.

1. *Pecopteris* sp. (cf. *P. Hillæ*, Walkom) from the shales of Mount Nicholas.
2. *Chiropteris tasmanica*, n.sp. Diagram to show venation.

Note.—Since this paper was written Mr. P. B. Nye, Government Geologist of Tasmania, has pointed out that the fossil plants described have practically all been obtained from the Middle or Felspathic Sandstone Series, the classification of the Mesozoic Rocks known as "Trias-Jura" in Tasmania being as follows:

Upper Sandstone Series.

Middle or Felspathic Sandstone Series (up to 600 feet).

Lower or Ross Sandstone Series (up to 800 feet).

A.B.W.

17th July, 1925.

STUDIES IN TASMANIAN MAMMALS, LIVING AND EXTINCT.

No. XIII.

THE EARED SEALS OF TASMANIA.

By

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and

Clive Lord, F.L.S., Director of Tasmanian Museum, Hobart.

(Read 10th August, 1925.)

The following notes upon the eared seals that inhabit the islands and rocks of our coasts are contributed with a view to putting upon record such data as have been accumulated from time to time, respecting these interesting members of our native fauna. It is, as we have urged elsewhere, essential that a comprehensive study of our seals should be immediately undertaken, but, pending this, it is thought advisable to collect under a common heading such notes as we have hitherto committed to Museum registers, cards, and note books.

Quite recently Professor Wood-Jones has aided the taxonomy of the question by the publication of an interesting monograph upon South Australian Eared Seals in general, and the total result of his researches is now available. The extensive synonymy of the subject is tabulated in handy form, and the animals themselves are classified under three species of the genus *Arctocephalus.*

For the seal believed to be the most common resident of our smaller islands, Professor Wood-Jones proposes the new specific name of *doriferus,* an animal found in South Australian waters also. He also states that *Arctocephalus cinereus* inhabits the Straits Islands, but he is rather doubtful if the New Zealand seal *Arctocephalus fosteri* comes into our waters, although reports claim its appearance there, and Mr. Le Souef has claimed recently the Straits seal as *A. fosteri.* It will then be manifest that upon an extreme possibility no less than three species of eared seals may at times appear in Tasmanian waters, but, according to Professor Wood Jones, a single species covers most of the facts, the other two being more or less in the nature of "accidentals."

A considerable body of popular lore at our command supports the suggestion that allowing for sex, age, and seasonable variations, a single species will not cover all the facts, and thus again we urge the need for a systematic investigation into the whole seal question.

OSTEOLOGY.

We are indebted to Professor Wood-Jones for skulls of the South Australian seal of his list—*Arctocephalus cinereus*—but of the several skulls of Tasmanian seals available to us, this skull does not appear in our collections, although as likely as not the animal does come into the Straits as the Professor suggests.

At the same time our really adult, that is aged, and super-ossified skulls, come from animals well over eight feet in length (the limit set for *A. doriferus*), and, although they agree better with that species than with *A. cinereus* of the list, they do not comply with the sagittal and nuchal crest characters, unless of course we take skulls of less than twelve years of age. Skulls of eight, nine, ten, and eleven years still show phases of crest development, and we very much doubt if any male seals of our coasts ever acquire a maximum, in this matter, at anything earlier than twelve years.

Having pooled the resources of both of our Museums upon the item of seals' skulls, we find the following facts to obtain:—

A male of our eared seal, of at least twelve years of age, shows a sagittal crest that extends forwards to the middle of the orbital processes of the frontals, a total length of 135 mm. Bifurcating into a pair of V-shaped ridges, the super-ossification extends forwards until it involves the original maxillo-frontal sutures, which are buried beneath the bony overgrowth, as are practically all the sutures of the skull. This specimen was obtained at Cooee.

A male skull of 10½ to 11 years of age obtained by the Launceston Marine Board (from our coasts) shows much sutural extinction, a true crest of 90 mm., with a remaining incipient crest of 40 mm., and the bifurcating ridges well in evidence.

A male of 9½ to 10 years of age, from North Bay, South Eastern Tasmania (Tas. Mus. No. D. 737), shows an individual age variation, inasmuch as the crest is fairly well marked for 120 mm., but the secondary bifurcations are

still unossified. In the cranial regions this skull shows much super-ossification, but the maxillo-palatine sutures are all open.

In an 8 to 9 year-old male from Scamander (animal in the flesh measured over eight feet long) the sagittal crest is only 65 mm. long, all sutures are in evidence, and the ligamentum nucha was chiefly implanted into two well-marked fossæ 25 mm. long. The cranial areas of the skull show mottled super-ossification, and the whole skull generally might —in the absence of other evidence—be regarded as a fair example of a mature skull, but any characters derived from the condition of the sagittal crest would be tentative only.

In a male of 5 years of age, believed to have come from Barren Joey, the characters of the male skull are well marked off from those of the female, but the crest is now only developed as far forward as the parieto-frontal sutures, a matter of about 35 mm. in length. The texture of the skull is compact and an area of 35 x 25 mm. on either side of the crest is syndesmosially pitted and roughened. The fossæ for the nucha are nearer the centre than obtains in the older skull, and are shallow and less extensive in other ways.

FEMALE SKULLS.

In a fully adult female skull from Bicheno, Eastern Tasmania (Tas. Mus. D. 746), in which super-ossification has obliterated all the cranial sutures, ankylosed into a solid mass the whole of the hard palate and left no fenestrated bony tissue in evidence anywhere, the nuchal and sagittal crest conditions are as follows:—A long low sagittal crest is present, some 8 mm. in height and 90 mm. long, its foremost point of extension being 18 mm. behind the line of the left orbital process and 12 mm. behind the right process. Once seen, this female crest would never be mistaken for that of a young male, even if the calvarium of the skull alone were available. It is a well-formed solid, but low crest and its highest point is in the middle. The nasals in this skull extend backwards 6 mm. beyond the maxillo-frontal and sutures, and apparently this obtains in all the Tasmanian crania at our disposal. This should be noted as it does not agree with Professor Wood-Jones's determinative character for the species *doriferus*, of which he says—"Posterior ends "of the nasals nearly reaching posterior margins of the "superior maxillæ" (*loc. cit.*). The fossæ for the implantation of the nuchæ are well marked and extend for 25 mm.

beneath the crest—they are grooves rather than pits, thus adding another age character to the skull. It is at present assumed by us that this skull is at least 8 years old, and that female skulls mature much faster than male skulls, as the animals do themselves, but in the absence of skulls from duly branded animals, our data are comparative only, the standard taken being that of Californian seals.

In a mutilated female skull from Tamar Heads, in which the sutures are all open, the squamosal and otocranial elements are movable, and although the parietals are pitted no true super-ossification has taken place, we get the appended notes upon the crest. The total outline of the future crest is well indicated, its length being 85 mm. Its strongest ossification is at the fronto-parietal sutures, which later in life would have been its highest point. Except for its lesser development, it duplicates the conditions of the maturer skull just passed in review, and is distinct from the method of development found in the young male skull, in which latter the crest slowly creeps forward with a stronger posterior elevation throughout the process.

RECAPITULATION.

It would appear, therefore, that our most common eared seal is rather larger than Professor Wood-Jones allowed for in the construction of his table of specific characters of *Arctocephalus doriferus*, that its nasal and crest osteological data do not quite agree, but these are minor matters in a way, and easy of emendation if a study of the living creatures we are so strongly urging does not show them to belong to another species. As no age standards for our eared seals founded upon branded animals exist, we have set up the best standard the circumstances permit of, and its application to the development of the males and female sagittal and nuchal crests, should be of interest in any case.

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ON A SUPPOSED PHYLLOCARID FROM THE OLDER PALÆOZOIC OF TASMANIA.

By

F. Chapman, A.L.S.

(Communicated by Sir T. W. Edgeworth David.)

Plate X.

(Read 10th August, 1925.)

DESCRIPTION.

(?) *Hurdia davidi*, sp. nov.

Carapace (right valve), obovate, with a ventral prolongation (probably somewhat distorted by pressure); with a rounded anterior and prolonged posterior extremity. Dorsal edge gently convex towards the anterior, more strongly so in the posterior region. Ventral border concave near the abdominal arch, becoming convex and distally obscurely extended in the middle region, and meeting the concave margin anteriorly. Surface of carapace wrinkled with three or more undulatory folds, crossing obliquely from the upper anterior towards the lower posterior margin. Surface marked with coarse areolation. Dorsal margin crenulate to undulose, a character probably caused by the compression of the chitinous and inflated carapace.

DIMENSIONS.

Length, circ. 5 cm.

Height of carapace, excluding the ? ventral prolongation, 18 mm.

Total length of carapace, circ. 27 mm.

OBSERVATIONS.

There is very little doubt as to the organic origin of this specimen, as the wrinkling of the margin, referred to as the dorsal line, will show.

A comparison was made with the genus *Hymenocaris*, but the general shape is too trigonal or not sufficiently oval for that generic type. The nearest genus to which we can refer this fossil, but with some reservation, is *Hurdia*, described by Dr. C. D. Walcott (1) from the Middle Cambrian of Burgess County, British Columbia. In form the present specimen approaches more nearly to *Hurdia triangulata* (*loc. cit.*). An example of *Hurdia victoria*, Walcott, in the National Museum Coll. donated by the Smithsonian Institution through the kind offices of Dr. Bassler, shows a similar wrinkling of the dorsal margin to that in the present specimen.

LOCALITY.

Emu Bay Railway Line, 4 miles S. of Hatfield Plains, Tasmania.

EXPLANATION OF PLATE.

Fig. 1. Photograph of (?) *Hurdia davidi*, sp. nov. Magnified circ. $\frac{5}{3}$.

Fig. 2. Hypothetical restoration of carapace.

Note.—Professor David reports that the railway cutting where the Phyllocarid was found is between 49.9 miles and 50¼ miles.

Dip 42° N.N.W. at 50¼ miles.

Dip 45° E. at 49.9 miles, in black shales.

At 49 miles, basalt of Hadfield Plains (edge of plains).

(1.) Smithsonian Miscellaneous Collections. Vol. LVII., No. 6, 1912, p. 186, pl. XXXII., fig. 9—*Hurdia victoria*, and pl. XXXIV., fig. 1—*Hurdia triangulata*.

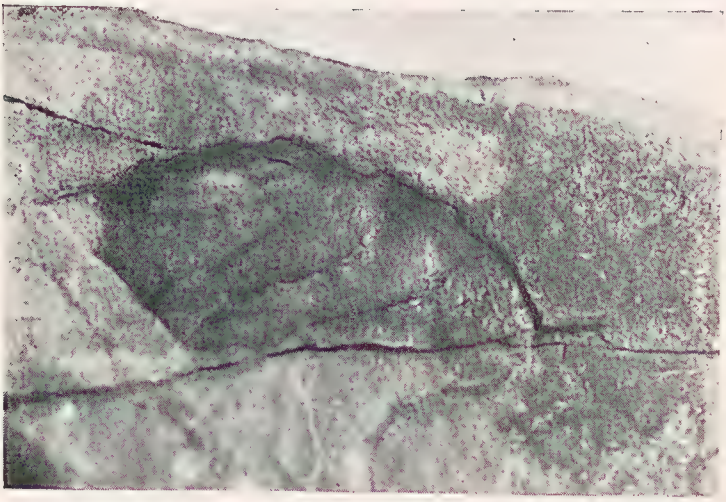

Figure 1.

Figure 2.

Fig. 1. Photograph of (?) *Hurdia davidi*, sp. nov. Magnified circ. $\frac{5}{3}$.

Fig. 2. Hypothetical restoration of carapace.

NEW AND LITTLE-KNOWN TASMANIAN LEPIDOPTERA.

By

A. Jefferis Turner, M.D., F.E.S.

(Read 12th October, 1925.)

Fam. NYMPHALIDÆ.

Subfam. Satyrinæ.

Nesoxenica leprea, Hew.

In Mount Wellington examples the wing-markings are pale yellow, sometimes in the ♂ almost white, and the black subcostal bar at 1/3 is usually, but not always, separate from the basal dark patch; in those from Cradle Mountain and other localities of the north-west the coloration is brownish-orange, which becomes paler in worn examples, and the subcostal bar appears to be always confluent with the basal patch. These two races are at present distinguishable, but this may not be so when the intermediate mountain areas have been collected over.

Though the larvæ probably, like those of other *Satyrinæ*, feed on grasses, this butterfly appears to be attached to the Tasmanian Beech ("Myrtle") (*Fagus cunninghami*). In Cradle Valley it was flying in abundance on the edges of the myrtle forest, and never far from it, whenever the day was fine. During cold and wet weather it might be beaten from the myrtle twigs, which were abundantly covered with a black and white lichen, with which its closed wings harmonised so perfectly that it was almost impossible to detect. This protective resembance appears to point to a close correlation, which has a very ancient origin.

Oreixenica lathoniella, Westw.

I recognise three local races of this species (*latialis*, W. & L., from Mt. Kosciusko, New South Wales, and *laranda*, W. & L., I regard as distinct species). They are (1) the typical race, which is confined to Tasmania, (2) the mainland race *herceus*, and (3) what appears to be a new race, for which I propose the name *barnardi*. This last was abundant

at Moina (2,000 ft.) on the Cradle Mountain Road, and a few were taken also in the Cradle Valley (3,000ft.). It is rather smaller than the other two. The upper surface of the wings resembles *herceus* rather closely. On the underside the spots on the hindwings are a brighter white (almost silvery) than in *herceus*, and in this they resemble typical *lathoniella*, but they are considerably smaller and narrower than in the other two races, while the ground colour is darker.

Oreixenica laranda, W. & L.

But a short distance separates the localities of *laranda* and *lathoniella*, and it is highly probable that they will be found to occur in the same localities. *Laranda* is a very distinct form, and I think the burden of proof should rest with those, who would consider it only a subspecies.

Oreixenica orichora, Meyr.

The Cradle Mountain form *flynni* differs from that taken on Mt. Kosciusko (1) in the apical ocellus being always double (in the latter it is very rarely so), (2) in the brown markings being less developed in proportion to the fuscous ground colour on the upper side, (3) in the whiter colour of the subterminal line of the forewings beneath, (4) in the spots on the underside of the hindwings being smaller and whiter, while the ground colour is darker, and (5) in the forewings being differently shaped, the apex more obtusely rounded, and the termen much more bowed. I should have attached more importance to the last difference, were it not that two specimens from Mt. Hotham, Victoria, received from Mr. Geo. Lyell, while agreeing with those from Mt. Kosciusko in other respects, are intermediate in shape of forewings. The Tasmanian form can, I think, be regarded only as a well-marked local race.

Arginnina hobartia, Westw.

The mainland species *A. cyrila*, W. & L., differs (1) in the ocelli being less developed, (2) in the basal spot of the forewings being confined to the cell, (3) in the shape of the forewings, which are notably longer, more produced, and narrower towards the apex, which is more sharply rounded, (4) in the presence in the ♂ of a cubital ridge of raised scales. I have placed these differences in the order of increasing importance. The last two are amply sufficient to indicate that *cyrila* is a distinct species, although closely allied.

Fam. LARENTIADÆ.

Pœcilasthena xylocyma, Meyr.

Mount Wellington (2,500 ft.) and Russell Falls in January; two ♀ examples exactly corresponding to a ♀ from Nowra, near Jervis Bay, New South Wales. Unfortunately in the absence of the ♂ it is impossible to be certain that this is the same as Meyrick's species, which was recorded from Albany, West Australia.

Pœcilasthena ædœa, n.sp.

αἰδοιος, modest.

♂ ♀. 24-28 mm. Head and thorax ochreous-whitish; fillet whitish; face brown. Palpi 2/3; ochreous-whitish. Antennæ ochreous-whitish; ciliations in ♂ minute. Abdomen ochreous-whitish, with two or three pairs of fuscous dorsal dots. Legs fuscous; posterior pair ochreous-whitish. Forewings triangular, costa gently arched, more strongly towards apex, apex round-pointed, termen slightly bowed, oblique; ochreous-whitish, with some minute dark-fuscous dots on veins, and numerous, fine, wavy, pale-fuscous transverse lines; median band ill-defined anteriorly, posteriorly defined by a band of three more or less fused lines, which are sometimes dark-fuscous on dorsum, outer edge from 4/5 costa to 2/3 dorsum, slightly bowed, and often marked by dark-fuscous dots or streaks on veins; a dark-fuscous discal dot in median band; two wavy subterminal lines enclosing an ochreous-whitish line; a series of elongate, interneural, dark-fuscous terminal dots; cilia ochreous-whitish. Hind-wings with termen rounded, slightly dentate, with a more prominent tooth on vein 4; as forewings, but without discal dot. Underside ochreous-whitish.

May be distinguished from the preceding by the different shape of hindwings; *scoliota*, Meyr., differs in the fuscous face and dots on thorax.

Russell Falls in January; Rosebery and Strahan in February; six specimens.

Microdes hæmobaphes, n.sp.

αἱμοβαφης, blood-stained.

♀. 23 mm. Head and thorax whitish mixed with fuscous and a few reddish scales. Palpi very long (5); whitish mixed with fuscous. Antennæ grey. Abdomen whitish, mixed with grey and reddish on dorsum. Legs fuscous; tarsi annulated with whitish; posterior pair wholly whitish.

Forewings elongate-triangular, costa rather strongly arched, apex round-pointed, termen slightly bowed, slightly oblique; whitish rather extensively, but patchily suffused with reddish, and with fuscous irroration and markings; a small basal patch defined by a strongly curved transverse line; several indistinct transverse lines precede and follow this; a broad median band, darker and more reddish-suffused, containing a minute fuscous discal dot; antemedian line from ¼ costa to 1/3 dorsum, outwardly curved, indented beneath costa and in middle, its posterior edge broadly suffused; postmedian from 2/3 costa, at first outwardly oblique, sharply angled above middle, thence wavy to dorsum about 2/3; immediately following it is a broad white line bisected by a fuscous line; some reddish suffusion in terminal area; a fine white dentate subterminal line; an interrupted fuscous terminal line; cilia whitish, barred with fuscous. Hindwings with termen strongly rounded; grey-whitish; towards termen suffused with grey; a faintly indicated subterminal whitish line; cilia grey-whitish. Underside whitish; forewings grey towards termen, with whitish subterminal line; hindwings with fuscous discal dot and postmedian line.

Lake Fenton (3,500 ft.) in January; one specimen (W. B. Barnard).

Eccymatoge iopolia, n.sp.

ἰοπολιος, purple-grey.

♂. Head purple-grey; fillet white; face fuscous. Palpi short (1), slender; fuscous. Antennæ grey, becoming white towards base; ciliations in ♂ very short (¼). Thorax purple-grey. Abdomen grey, with paired segmental dark-fuscous dots; crests and apices of segments white. Legs fuscous. Forewings triangular, costa nearly straight, slightly arched towards base and apex, apex pointed, termen bowed, oblique; whitish, densely suffused with purple-grey; lines fuscous; an undefined darker basal patch containing several obscure oblique lines; antemedian from 1/3 costa to 2/5 dorsum, crenulate, sometimes interrupted; closely followed by a fuscous discal dot; an irregularly dentate line from 2/3 costa to mid-dorsum; another irregularly dentate line, edged posteriorly with whitish, from 5/6 costa to 2/3 dorsum, the space between this and previous line filled in with dark purple-grey; a slightly dentate fuscous subterminal line, followed by a slender submarginal line; a terminal series of dark-fuscous lunules; cilia whitish, with an interrupted, grey, median line. Hindwings with termen

rounded, slightly dentate; as forewings, but without basal patch, and markings less defined. Underside grey; markings very obscure.

Cradle Mountain (3,000 ft.) in January; two specimens.

Eucymatoge liometopa, n.sp.

Λειομετωπος, smooth-faced.

♂. 24-28 mm. Head fuscous; face with slight rounded prominence, only slightly rough-scaled, without frontal tuft; blackish. Palpi 1½; blackish. Antennæ fuscous; in ♂ very shortly ciliated. Thorax and abdomen fuscous mixed with blackish. Legs fuscous; posterior pair fuscous-whitish. Forewings triangular, costa slightly arched, apex pointed, termen bowed, oblique, crenulate; brown-whitish, with indistinct, wavy, fuscous, transverse lines; an ill-defined darker basal patch; median band ill-defined anteriorly, edged posteriorly by a fuscous line, partly margined by a whitish line or by whitish dots on veins, containing several obscure fuscous lines and a blackish discal dot; a narrow brownish shade immediately follows median band; a very indistinct, whitish, wavy, subterminal line; a fuscous terminal line interrupted on veins; cilia fuscous. Hindwings with apex quadrangular on vein 7, an acute tooth on vein 6, a larger acute tooth on vein 4, and three small dentations between this and tornus, termen with a deep semicircular incision between veins 4 and 6; as forewings, but without basal patch and discal dot. Underside fuscous-grey, with no defined markings.

This obscure species is readily distinguishable by the form of frons and termen of hindwings. These peculiarities do not seem to me to justify generic separation.

Russell Falls, National Park, in January; four specimens.

Horisme leucophanes.

Hydriomena leucophanes, Meyr., 1890, p. 856.

♂ ♀. 34-38 mm. Head brownish-grey. Palpi in ♂ 2½, in ♀ 3; fuscous. Antennæ grey; ciliations in ♂ minute. Thorax brownish-grey; a small posterior dark-fuscous crest. Abdomen grey. Legs fuscous; anterior pair darker. Forewings elongate-triangular, costa nearly straight except towards apex, apex acute, termen bowed, strongly oblique, crenulate, dorsum slightly arched; grey-whitish with numerous, fine, wavy, fuscous or brownish, oblique lines; a broad,

oblique fuscous or brownish streak from 1/5 costa towards, but not reaching costa at 1/3; median band not defined anteriorly, but its central area free from lines, more or less whitish, and containing a blackish discal dot; in one example a suffused blackish spot in median band below middle; posterior edge of median band more or less defined by a fine dark-fuscous line from 5/6 costa, twice waved outwards in disc, then inwardly oblique to 2/3 dorsum; lines immediately following, and sometimes those preceding, this are brownish; a short, oblique, pale, apical shade, edged beneath with dark-fuscous; a dark-fuscous terminal line; cilia grey. Hindwings broad, termen only slightly rounded, dentate; whitish, towards termen suffused with grey; several short grey lines from dorsum; a slender, fuscous, transverse line from 2/3 dorsum to beyond middle of disc; terminal line and cilia as forewings. Underside grey; markings very undefined, but a blackish discal dot on both wings.

Meyrick's description is from a single example. The species is somewhat variable.

Lake Fenton, National Park (3,500 ft.), Deloraine, Rosebery, Strahan. Also from Sale, Victoria.

Gen. EPIRRHOE.

Epirrhoë, Hb., Verz., p. 328.

Face rough-scaled, usually with projecting tuft. Tongue well-developed. Palpi porrect or subascending, moderate, rough-scaled. Antennæ in ♂ ciliated. Thorax and abdomen not crested. Thorax not hairy beneath. Posterior tibiæ, with two pairs of spurs. Forewings with areole simple. Hindwings with 5 from above middle of discocellulars.

Type *E. rivata*, Hb., from Europe. This genus is new to Australia. In my key (Trans. Roy. Soc. S.A. 1922, p. 229) it falls with *Chætolopha*, but in that genus the areole extends to 1/3 of the distance between cell and apex, while in this it does not reach ¼. The neuration of the hindwings also differs, and the genera are not in fact closely allied, the affinities of *Epirrhoë* being rather with *Euphyia*. It is also allied to the New Zealand genus *Homodotis*, Meyr. [subsequently merged by Meyrick with *Asaphodes*, but I think incorrectly], which has, however, pectinate ♂ antennæ.

Epirrhoë eustropha, n.sp.

εὐστροφος, well-banded.

♂. 28 mm. Head grey, with a few ochreous scales on crown. Palpi 2; grey, towards base whitish. Antennæ

grey; in ♂ slightly dentate, very shortly ciliated (¼). Thorax grey, mixed with whitish-ochreous. Abdomen grey, irrorated with reddish; three pairs of obscure fuscous dots on dorsum; tuft fuscous. Legs fuscous, irrorated, and tarsi annulated with ochreous-whitish. Forewings triangular, costa moderately arched, apex pointed, termen bowed, oblique; whitish sparsely irrorated with brownish and a few fuscous scales; basal patch small, purple-grey, limited by a curved, transverse, fuscous, sub-basal line; median band also purple-grey, limited by fuscous lines, and containing two very slender fuscous lines, and a minute discal dot; antemedian line from 1/3 costa to 2/5 dorsum, slightly irregular, slightly outwardly curved; postmedian from 2/3 costa to ¾ dorsum, wavy, with slight, obtuse, median convexity; some darker suffusion towards apex and termen; a fuscous terminal line interrupted on veins; cilia grey, with a subapical whitish line. Hindwings with termen rounded; ochreous-whitish; a series of very faint, fuscous, transverse lines from dorsum, lost in disc; a fuscous terminal line; cilia whitish with an obscure grey median line. Underside ochreous-whitish, with fuscous suffusion, discal dot, and postmedian line on both wings.

Mt. Wellington (2,500 ft.), in January; one specimen.

Epirrhoë callima.

Hydriomena callima, Turn., Proc. Roy. Soc. Vic., 1903, p. 257.

♀. 26-28 mm. Head, thorax, and abdomen dark-fuscous irrorated with pale-ochreous. Palpi 2¼; pale-ochreous irrorated with dark-fuscous. Antennæ dark-fuscous. Legs dark-fuscous, irrorated, and tarsi annulated, with pale-ochreous. Forewings triangular, costa arched near base, thence nearly straight, apex pointed, termen slightly bowed, slightly oblique; dark-fuscous, with white and brown transverse lines; a small dark basal patch edged by a slender, whitish, outwardly curved, transverse, sub-basal line; this is followed by a transverse brown band, bisected by a dark-fuscous line; median band broad, dark-fuscous, but somewhat paler in centre, containing a blackish discal dot, a blackish dot on midcosta, preceded by a crenulate transverse blackish line, and followed by two such lines, the second incomplete; antemedian from 1/3 costa to 1/3 dorsum, white, slender, broader on costa, acutely indented above and below middle; postmedian from 2/3 costa to 4/5 dorsum, white, broad in upper

half, slender below, slightly indented beneath costa, with an obtuse, double, median prominence, between this and dorsum, finely crenulate, edged posteriorly by a slender blackish line, and this by a broader brown line, and this again by a blackish line; a short, slender, white streak from costa before apex; some white dots indicating a subterminal line; an interrupted blackish terminal line preceded by slight brown suffusion; cilia dark-fuscous barred with pale-ochreous. Hindwings with termen rounded; orange; suffused with fuscous at base; several short fuscous lines from dorsum; a broad dark-fuscous terminal band, interrupted in middle; cilia ochreous with small dark-fuscous bars.

Underside pale-ochreous; forewings with blackish post-median and terminal bands, the latter with a subterminal series of whitish dots; hindwings with four fine transverse blackish lines or series of dots, and whitish subterminal dots.

Cradle Mountain (3,000 ft.), in January; three specimens. The type is from Strahan.

Euphyia orthropis, Meyr.

Mt. Wellington (2,500 ft.) and Cradle Mountain (3,000 ft.), in January; six specimens. These form a local race, which may be known as *tasmanica*, differing from the typical Mt. Kosciusko form in the forewings being fuscous, with scarcely any brownish tinge, postmedian line with usually a very slight bidentate median projection, and cilia with terminal half not or only very slightly barred with whitish.

Euphyia hilaodes, n.sp.

ἱλαώδης, of cheerful appearance.

♀. 30-34 mm. Head fuscous, irrorated with pale-ochreous and crimson. Palpi 2¼; fuscous, some irroration, and lower edge towards base pale-ochreous. Thorax fuscous, mixed with brown. Abdomen brown; apices of segments whitish; paired dark-fuscous dorsal segmental spots. Legs fuscous, irrorated, and tarsi annulated, with pale-ochreous. Forewings broadly triangular, costa gently arched, apex pointed, termen slightly bowed, slightly oblique, crenulate; pale-brown, median band darker brown; a moderate basal patch containing two darker transverse lines, limited by a slightly sinuate, fuscous, whitish-edged, transverse line; beyond this is a paler band containing a crenulate, fuscous, transverse line; median band moderate, in one example interrupted above dorsum, containing several similar fuscous lines and

a subcostal discal dot before middle; antemedian from 1/3 costa to 1/3 dorsum, whitish edged posteriorly with fuscous, slightly indented beneath costa and below middle; postmedian from 2/3 costa to 2/3 dorsum, whitish, edged anteriorly and posteriorly with fuscous, slightly waved outwards beneath costa, with a slight or moderate, double-toothed, median projection; postmedian followed by a pale-brown (sometimes whitish), and this by a fine fuscous line; a finely crenulate, slender, whitish, subterminal line; a fuscous terminal line; cilia fuscous, bases and apices paler or whitish. Hindwings with termen rounded, crenulate; whitish, suffused more or less with pale-ochreous; numerous, short, fuscous, and whitish lines from dorsum; some fuscous suffusion towards base; terminal line and cilia as forewings.

Near *E. lamprotis*, Meyr., but sufficiently distinct by the larger size, shorter palpi, crimson scales on head, indented antemedian line, projection of postmedian line less pronounced, and hindwings not orange.

Mt. Wellington (2,500 ft.), Russell Falls, and Moina (2,000 ft.), in January; Rosebery in February; six specimens, all ♀, and three of them wasted, so that I evidently came late in their season.

Euphyia heterotropa, n.sp.

ἑτεροτροπος, of different sort.

♂ ♀. 28-32 mm. Head and thorax fuscous, irrorated with whitish. Palpi 3; whitish, irrorated with fuscous; basal joint wholly whitish. Antennæ fuscous; in ♂ simple, ciliations minute. Abdomen fuscous, mixed with orange. Legs fuscous. Forewings triangular, costa gently arched, apex round-pointed, termen bowed, slightly oblique; brownish-fuscous; an outwardly-curved, slightly dentate, whitish, subbasal, transverse line; a whitish antemedian line from 1/3 costa to 2/5 dorsum, outwardly-curved, acutely indented beneath costa and below middle; postmedian from 2/3 costa to 4/5 dorsum, whitish, at first transverse, then bent slightly inwards, then outwards to form a strong, median, obtuse projection, slightly bifid at apex, slightly incurved, and indented between this and dorsum; median band contains some obscure fuscous transverse lines and a discal dot; postmedian succeeded by a narrow pale-brownish suffusion; a fine, crenulate, whitish, subterminal line, preceded by some suffused fuscous spots; an interrupted, dark-fuscous, terminal line; cilia fuscous, bases mixed with brownish. Hind-

wings with termen rounded, wavy; dull-orange, with dark-fuscous markings; fine transverse lines at ¼, 1/3, middle, and slightly beyond middle, the last with an angular post-median projection; subterminal and submarginal series of spots, larger and sometimes partly confluent towards apex; terminal line and cilia as forewings. Underside pale-orange, with blackish lines and discal dot on both wings; subterminal of forewings ceasing abruptly above middle, and margined posteriorly by whitish dots.

Not near any other Australian species. In two specimens the areole is simple on one side only.

Moina (2,000 ft.) and Middlesex Plains (2,500 ft.), in January; six specimens.

Gen. Aprosdoceta, nov.

ἀπροσδοκητος, unexpected.

Face rough-scaled. Tongue present. Palpi moderate, porrect, rough-scaled; terminal joint short. Antennæ in ♂ bipectinate to apex, pectinations long, one pair to each segment. Thorax and abdomen not crested. Thorax not hairy beneath. Posterior tibiæ, with two pairs of spurs. Forewings with outer wall of areole not developed, in ♂ 5 and 6 stalked from near upper angle of cell, 7 free, in ♀ 5 from slightly above middle of cell, 6 and 7 stalked from angle, in both 8, 9, 10, 11 stalked. Hindwings with discocellulars sometimes bent, 5 from junction of upper and middle thirds above bend. Type *A. chytrodes*.

I am unable to suggest any explanation for the extraordinary difference in the neuration of the two sexes. That of the ♀ is nearly the same as in *Acodia*.

Aprosdoceta orina, n.sp.

ὀρεινος, of the mountain.

♂. 42 mm. Head fuscous, irrorated with whitish-brown. Palpi 2½; fuscous; basal and apical joints whitish. Antennæ fuscous; pectinations in ♂ 10. Thorax fuscous. Abdomen brown-whitish, with slight irroration and two or three pairs of dorsal dots fuscous. Legs fuscous; posterior pair whitish, with a few fuscous scales. Forewings triangular, costa very slightly arched, apex pointed, termen longer than dorsum, bowed, strongly oblique; whitish, with fuscous irroration and markings; numerous fine transverse lines; one sub-basal and two near base represent the basal patch; antemedian from ¼ costa to 1/3 dorsum, dentate in dorsal

half; postmedian from ¾ costa to 4/5 dorsum, with an acute posterior tooth beneath costa, a median projection bearing two acute teeth, thence strongly inwardly curved, curved outwards again to dorsum; median area contains a discal dot before middle, and some fine obscure transverse lines; two fine crenulate lines between postmedian and termen; cilia whitish. Hindwings elongate, apex prominent, rounded, termen very slightly rounded, wavy; whitish, with obscure indications of short transverse lines from dorsum; cilia whitish. Underside of forewings similar, but markings suffused and indistinct, of hindwings with fuscous discal dot, antemedian, median, and postmedian lines, the last dentate.

Lake Fenton (3,500 ft.), in January; one specimen, rather worn.

Aprosdoceta chytrodes, n.sp.

χυτρωδης, earthen.

♂ ♀. 38-44 mm. Head and thorax ochreous-whitish, mixed with brown and fuscous. Palpi of ♂ 2, of ♀ 2½; fuscous; inferior surface and apex ochreous-whitish. Antennæ grey; pectinations in ♂ 12. Abdomen ochreous-whitish, in ♀ irrorated with brown, with several median dorsal fuscous spots. Legs ochreous-whitish, irrorated with fuscous; anterior pair fuscous; anterior tarsi annulated with ochreous-whitish. Forewings broadly triangular, costa gently arched, apex round-pointed, termen bowed, oblique, crenulate; whitish-brown with numerous fine, fuscous, wavy, transverse lines; a small basal patch extending twice as far on costa as on dorsum, darker, containing several fuscous lines; two fine fuscous lines precede median band; median band darker-brown, containing two anterior and three posterior suffused fuscous lines, and a fuscous discal dot before middle; antemedian line from ¼ costa to 1/3 dorsum, indented beneath costa, thence wavy; postmedian from ¾ costa to 2/3 dorsum, wavy, with slight, double, median prominence; this is followed by a whitish line; four fuscous posterior lines; subterminal whitish, crenulate, very indistinct; a broad, pale, oblique streak from apex, suffusedly margined with fuscous; an interrupted, fuscous, terminal line; cilia ochreous-whitish, apices fuscous. Hindwings with apex and tornus subrectangular, termen only slightly rounded, dentate; ochreous-whitish, with many wavy transverse lines, most developed towards dorsum; cilia as forewings. Underside of both wings ochreous-whitish, with wavy, transverse, fuscous lines, and an antemedian dark-fuscous discal dot.

Lake Fenton (3,500 ft.), in January; six specimens (W. B. Barnard).

Gen. ACODIA, Rosen.

Face with anterior cone of scales. Palpi moderate, porrect, rough-scaled. Antennæ of ♂ bipectinate almost to apex. Abdomen with a slight dorsal crest on third segment. Posterior tibiæ with two pairs of spurs. Forewings without areole, 6 and 7 approximated, connate, or stalked, 8, 9, 10, 11 stalked. Hindwings with discocellulars only slightly bent, 5 from junction of upper and middle thirds.

The absence of the areole is due to non-development of its outer wall. I am now of opinion that this genus should be maintained. Out of a series of nine examples, including both sexes, I find no deviation from the neuration described; examples with the areole developed are apparently exceptional.

Xanthorhoë pyrrhobaphes, n.sp.

πυρρόβαφης, suffused with red.

♂. 34 mm. Head and thorax reddish-brown. Palpi 2½; fuscous, mixed with brown; at base ochreous-whitish. Antennæ grey; ciliations in ♂ 10. Abdomen ochreous-whitish, with paired, dorsal, reddish-fuscous spots. Legs dark-fuscous; tarsi annulated with whitish; posterior pair ochreous-whitish. Forewings broadly triangular, costa slightly arched, more strongly towards apex, apex subrectangular, termen slightly bowed, slightly oblique; very pale reddish, with minute dark-fuscous dots on veins; costal edge rather deeper red; a basal patch, consisting of three or four reddish-fuscous transverse lines; median band moderately broad on costa, much narrower below middle; a blackish median discal dot; anterior edge of median band slightly outwardly curved, formed of two fine, wavy, fuscous lines, the intervening space filled in with red above middle and on dorsum; posterior edge of three such lines, filled in with red on upper third, there angled; subterminal indicated by a darker crenulate shade; a terminal series of paired fuscous dots; cilia fuscous, apices pale-reddish. Hindwings with termen rounded; grey-whitish, with several fine fuscous lines from costa; terminal dots and cilia as forewings. Underside of both wings pale-reddish, with fuscous discal dot, and interrupted postmedian line.

A second example is differently coloured, being uniformly grey, with reddish suffusion only on basal patch, median band, and to a less extent on costa and termen of forewing.

The species is therefore variable. Any possible confusion with *pauper*, Rosen., may be avoided by noticing the different form of wing margins.

Moina (2,000 ft.), in January; two specimens (W. B. Barnard).

Xanthorhoë amblychroa, n.sp.

ἀμβλυχροος, dull-coloured.

♂. 26-28 mm. Head and thorax whitish-brown, irrorated with fuscous. Palpi 2½; brown-whitish, irrorated with fuscous. Antennæ fuscous; pectinations in ♂ 6, apical 1/3 simple. Abdomen brown-whitish, irrorated with fuscous. Legs fuscous, irrorated, and tarsi annulated, with brown-whitish; posterior pair mostly brown-whitish. Forewings elongate-triangular, costa nearly straight, apex pointed, termen nearly straight, oblique; brown-whitish, with fuscous irroration and markings; a number of short, fuscous, costal strigulæ, some of which give rise to transverse lines, three suffused sub-basal lines; antemedian from 2/5 costa to 2/5 dorsum, slightly dentate, obscure; postmedian from ¾ costa to ¾ dorsum, better defined white-edged posteriorly, wavy, with an obtuse median projection, thence inwardly curved to dorsum; median area contains an obscure discal dot, and below this a small brownish mark; a very slender, wavy, white, subterminal line; an interrupted, blackish, terminal line; cilia whitish, mixed with brownish-fuscous. Hindwings with termen rounded, wavy; whitish-grey; a fuscous discal dot at 1/3; obscurely darker postmedian and subterminal transverse lines; terminal line and cilia as forewings. Underside similar, but markings on hindwings better defined.

Hobart, in December; two specimens received from Mr. R. A. Black.

Xanthorhoë bituminea, n.sp.

bitumineus, like asphalt.

♀. 30 mm. Head, thorax, and antennæ fuscous. Palpi 2½; fuscous. Abdomen fuscous; obscurely darker, paired, dorsal dots separated by median brownish dots. Legs fuscous; tarsi annulated with whitish. Forewings triangular, costa nearly straight to shortly before apex, apex acute, termen sinuate, oblique; fuscous, obscurely marked with slender, wavy, dark-fuscous, obliquely transverse lines; no defined basal patch; median band hardly darker; antemedian line hardly distinguishable; postmedian defined by a very slight, whitish posterior margin, from 5/6 costa to 4/5 dorsum; subterminal line obsolete; cilia fuscous. Hindwings with

termen only slightly rounded, crenulate; grey; with several very slender, obscure, short, transverse lines from dorsum; a darker terminal line; cilia grey, apices paler. Underside fuscous; markings on forewing ill-defined; hindwings with blackish discal dot at 1/3, and three slender, curved, transverse, dark lines at and beyond middle.

My second example is a well-marked aberration, differing as follows:—Thorax suffused with brown. Forewings with brown antemedian and postmedian bands, the latter bifurcating near costa, its outer branch running to apex.

Though the ♂ is unknown, I think this species is allied to *centroneura*, Meyr., and *epia*, Turn.

Rosebery, in February; two specimens.

Gen. ACALYPHES, nov.

ἀκαλυφης, uncovered, open.

Face rough-scaled. Tongue strong. Palpi moderate, porrect, hairy. Antennæ of ♂ thickened, simple, ciliations imperceptible. Thorax with a small posterior crest; hairy beneath. Abdomen without crests. Coxæ and femora hairy. Posterior tibiæ with two pairs of spurs. Forewings without areole, 5 from middle of cell, 6 from upper angle, 7, 8, 9, 10 stalked from before angle, 11 free. Hindwings with cell very long (¾), 5 from middle of cell, 6 and 7 connate or short-stalked.

One of the *Dasyuris* group. The anomalous neuration can be explained by the non-development of the costal wall of the areole (disconnecting veins 10 and 11), leaving the areole open. I do not know any other instance in which this occurs.

Acalyphes philorites, n.sp.

φιλοριτης, a mountaineer.

♂ ♀. 22-24 mm. Head and thorax dark-fuscous, with some white irroration. Palpi 2; dark-fuscous, mixed with white. Antennæ dark-fuscous. Abdomen and legs fuscous, irrorated with ochreous-whitish. Forewings triangular, costa arched near base, thence nearly straight, apex rounded-rectangular, termen slightly bowed, scarcely oblique; fuscous with some whitish suffusion in disc; an ill-defined whitish sub-basal spot; a dark-fuscous, somewhat dentate, transverse line from 1/3 costa to 2/5 dorsum, suffusedly margined with white, preceded by a dark-fuscous subdorsal spot; a median transverse line, angulated outwards in middle, some-

times indistinct; a dark-fuscous line from 2/3 costa to dorsum before tornus, irregularly dentate, with a strong median posterior tooth, edged posteriorly by a broad white line, much narrowed on median prominence; dark-fuscous suffused spots follow this above middle and above tornus; an interrupted dark-fuscous terminal line; cilia fuscous, bases sometimes whitish. Hindwings with termen strongly rounded; fuscous; disc in ♀ suffused with whitish-ochreous; a white or whitish-ochreous, strongly marked, postmedian line, strongly angled posteriorly in middle, and again at tornus; cilia fuscous.

Cradle Mountain (3,000 ft.), in January; two specimens (W. B. Barnard).

Dasysternica bertha, n.sp.

Epirrhoë bertha, Swin., Trans. Ent. Soc., 1902, p. 648.

Dasysternica crypsiphœna, Turn., Trans. Roy. Soc. S.A., 1922, p. 257.

♂ ♀. 25-29 mm. Head, thorax, abdomen, and palpi dark-fuscous, with some whitish irroration; palpi 3, clothed with long rough hairs. Antennæ dark-fuscous; in ♂ slightly serrate and shortly ciliated (2/3). Legs dark-fuscous, irrorated, and tarsi annulated with whitish. Forewings triangular, costa very slightly arched, apex pointed, termen bowed, oblique; whitish, densely irrorated with fuscous, sometimes with scattered patches of brownish, and marked with dark-fuscous, more or less crenulate, transverse lines, which are more distinct in ♀; three or four suffused lines before antemedian; antemedian from 1/3 costa to 2/5 dorsum, slightly outwardly curved, slightly dentate; two or three lines in median band, whose centre is paler and contains a subcostal, antemedian, blackish, discal dot; postmedian from 2/3 costa to 4/5 dorsum, dentate, with a small subcostal and a moderate, double, median projection; this is followed by a narrow whitish line, more or less suffused; dark-fuscous subterminal and terminal lines, the latter interrupted; cilia fuscous, apices barred with whitish. Hindwings with termen rounded; dark-grey; slightly darker transverse lines, edged posteriorly with whitish, about 1/3, middle, and 2/3; the last of these is followed by a distinct whitish line, which is sometimes double; terminal line and cilia as forewings. Underside of both wings fuscous-whitish, with three dark-fuscous, crenulate, transverse lines, and a dark-fuscous subterminal shade.

The brown markings on the forewings vary much, and may be altogether absent. I have therefore redescribed the species. Some difficulty may arise as to its generic position. Of 9 male examples examined 5 have the areole simple on both sides, 2 simple on one side, double on the other, 2 double on both sides; of 10 female examples 9 have it simple on both sides, one simple on one side only. That is to say, of 38 wings 31 (81.6%) are simple, 7 (18.4%) double. This form of structural variation is exceptional.

Mt. Wellington (3,500-4,000 ft.); Lake Fenton (3,500 ft.); Cradle Mountain (3,000 ft.); in January; common.

Fam. BOARMIADÆ.

Boarmia epiphlœa, n.sp.

ἐπιφλοιος, on bark.

♂ ♀. 44-50 mm. Head grey; face dark-fuscous, with two whitish-ochreous transverse lines, above middle and on lower edge. Palpi 1¼; ochreous-whitish; terminal joint fuscous. Antennæ fuscous; ciliations in ♂ 12, extreme apex simple. Thorax pale-grey, with a blackish transverse line near anterior end. Abdomen pale-grey; sometimes fuscous spots on dorsum of second and third segments. Legs grey; anterior pair fuscous. Forewings triangular, costa nearly straight, apex pointed, termen very slightly bowed, oblique, crenulate; 10 and 11 long-stalked, 10 connected with 9 (3♂, 3♀); pale-grey; costa strigulated with fuscous; a slender blackish line from base, beneath and parallel to costa, not reaching middle; two very slender fuscous lines from dorsum near base and at ⅓, strongly outwardly oblique, lost in disc; a blackish line from termen beneath apex to middorsum, strongly waved, sometimes thickened; terminal area beyond this is darker grey; a short, slender, blackish, oblique streak from costa before apex; a slender, whitish, finely-waved subterminal line, its posterior edge sometimes with blackish dots, which may be connected by fine streaks between veins with a blackish terminal line; cilia grey, apices paler. Hindwings with termen straight, dentate towards apex, wavy towards tornus, which is rectangular; as forewings, but lines transverse, including a single, complete, antemedian line. Underside grey, with fuscous discal dots, and postmedian line of dots, sometimes indistinct.

Readily distinguished from *B. lyciaria* by the differently shaped hindwings and absence of yellowish colouring beneath.

Moina (2,000 ft.), in January; Strahan, in February; six specimens.

Boarmia epiconia, n.sp.

ἐπικονιος, covered with dust.

♂ ♀. 36-40 mm. Head whitish; face dark-fuscous, upper and lower edge whitish. Palpi 1; ochreous-whitish, towards apex fuscous. Antennæ grey; pectinations in ♂ 3, extreme apex simple. Thorax whitish, with a few fuscous scales. Abdomen whitish; some fuscous irroration, and paired, fuscous, dorsal dots on third and fourth segments. Legs fuscous; tarsi annulated with ochreous-whitish; posterior pair ochreous-whitish. Forewings triangular, costa gently arched, apex rather sharply pointed, termen bowed, oblique; 10 and 11 long-stalked, free (1 ♂), their common stalk connected with 12 (1 ♀); whitish with moderate fuscous irroration and fuscous lines; costa finely strigulated with fuscous; an elongate dot beneath costa at 1/3, and a median discal dot fuscous; lines strongly oblique; a very slender interrupted line from dorsum near base to about middle; sometimes a similar line beyond and parallel to this; a dark-fuscous, more distinct, interrupted line from mid-dorsum, not reaching costa; this is closely followed by a suffused, somewhat dentate, fuscous line; a whitish crenulate or dentate subterminal line; a terminal series of dark-fuscous dots between veins; cilia whitish. Hindwings with termen slightly rounded, wavy; as forewings, but lines transverse and complete. Underside pale-grey, with faint discal dot and postmedian line on both wings.

Mt. Wellington (3,000 ft.), in January; two specimens (W. B. Barnard).

Boarmia proschora, n.sp.

προσχωρος, adjacent.

♂. 35 mm. Head whitish; face dark-fuscous, upper and lower edge whitish. Palpi 1; whitish, towards apex fuscous. Antennæ grey; pectinations in ♂ 2, extreme apex simple. Thorax whitish with two pairs of fuscous spots. Abdomen whitish, with slight fuscous irroration, and paired, fuscous, dorsal dots on third and fourth segments. Legs fuscous; tarsi annulated with whitish; posterior pair whitish. Forewings rather narrowly triangular, costa gently arched, apex round-pointed, termen bowed, strongly oblique, crenu-

late; 10 and 11 long-stalked, free (1 ♂); whitish with fuscous irroration, costal strigulation, and lines; antemedian line from a spot on 1/3 costa, dentate beneath costa, thence strongly oblique to near base of dorsum; a median, fuscous, discal dot; a very slender sinuate median line; postmedian from a spot on 2/3 costa, dentate beneath costa, thence strongly oblique to mid-dorsum; a faint, whitish, crenulate, subterminal line; a terminal series of fuscous dots between veins; cilia whitish, a fuscous bar beneath apex. Hindwings with termen slightly rounded, crenulate; as forewings, but lines transverse; postmedian finely dentate; subterminal edged anteriorly by a fuscous line. Underside pale-grey, with fuscous discal dots on both wings.

Very similar to the preceding, but recognisable by the shorter antennal pectinations, forewings narrower, less acute at apex, termen crenulate, lines more complete, ending on costal spots.

Zeehan in February; one specimen.

Boarmia atycta, n.sp.

ἀτυκτος, unfinished.

♀. 46 mm. Head grey-whitish; face with a few fuscous scales only. Palpi 1½; white, towards apex mixed with fuscous. Antennæ fuscous. Thorax and abdomen whitish mixed with dark-fuscous. Legs fuscous; tarsi with whitish annulations; posterior pair mostly whitish. Forewings triangular, costa nearly straight, apex subrectangular, termen bowed, slightly oblique, wavy; 10 and 11 very long-stalked, 10 connected or anastomosing with 9 (1 ♀); whitish, irrorated throughout, and costa strigulated, with dark-fuscous; markings grey, nearly obsolete; a suffused, outwardly curved, dentate, sub-basal, transverse line; a dark-fuscous discal dot before middle; a broadly suffused postmedian line from ¾ costa to 2/3 dorsum, containing some dark-fuscous streaks on veins; traces of a dentate, whitish, subterminal line; a terminal series of dark-fuscous interneural dots, somewhat prolonged inwards; cilia whitish, with some fuscous scales. Hindwings with termen rounded; crenulate; as forewings, but without sub-basal line; discal dot at 1/3; postmedian line double, but only distinct towards dorsum. Underside pale-grey, with fuscous irroration and discal dot on both wings.

A moderately large but very obscure species.

Lake Fenton (3,500 ft.), in January; one specimen (W. B. Barnard).

Syneora symphonica, n.sp.

συμφωνικος, harmonious.

♂ ♀. 32-38 mm. Head grey; fillet darker; face prominent. Palpi in ♂ 1½, in ♀ 2; whitish, towards apex mixed with grey. Antennæ grey; pectinations in ♂ 8, apical 1/5 simple. Thorax grey. Abdomen grey-whitish, with a few dark-fuscous scales. Legs fuscous; tarsi with whitish annulations; posterior pair mostly whitish. Forewings triangular, costa gently arched, apex round-pointed, termen slightly bowed, slightly oblique, slightly wavy; 10 and 11 separate, connate or short-stalked, 11 usually anastomosing or connected by a bar with 12, occasionally 11 apparently out of 12; grey-whitish, at base, terminal area, and beyond antemedian line slightly darker, with sparse dark-fuscous irroration; a moderate basal patch partly defined by a very fine dark-fuscous line; antemedian from midcosta to 2/5 dorsum, slender, fuscous, nearly straight; a fuscous, median, discal dot; second line similar, from 4/5 costa, doubly sinuate, bent strongly inwards above dorsum to end on mid-dorsum, very fine towards dorsum, somewhat thickened in middle, edged anteriorly throughout by a whitish line; a terminal series of small interneural dots; cilia grey-whitish. Hindwings with termen rounded; whitish, towards dorsum and termen irrorated with fuscous; several short fuscous transverse lines from dorsum, lost in disc; a discal dot before middle; cilia grey-whitish. Underside whitish finely strigulated with fuscous; a discal dot on both wings.

Within the limits indicated above, 10 and 11 of forewings are excessively variable, so much so that of nine specimens examined in only one was the neuration the same on both sides.

Beaconsfield, in February; Moina (2,000 ft.), in January; Rosebery, in February; nine specimens (W. B. Barnard).

Cleora nesiotis, n.sp.

νησιωτις, an islander.

♀. 40 mm. Head and thorax whitish-grey; face fuscous, lower edge whitish. [Palpi missing.] Antennæ pale-grey; in ♀ very shortly bipectinate (½), apical ¼ simple. Abdomen and legs whitish-grey, with a few fuscous scales. Forewings elongate-triangular, costa straight, apex pointed, termen bowed, oblique, crenulate; 10 and 11 separate and free; whitish-grey with a few fuscous scales; markings fuscous; a slender, incomplete, curved line from 1/6 costa to dorsum

near base; a discal dot beneath midcosta; a sinuate line, from 3/5 costa to mid-dorsum, with an acute posterior tooth above middle, angled inwards above dorsum; a line from costa before apex, at first very obliquely inwards, then bent to form an acute posterior tooth, after that it runs inwards to become closely applied and parallel to the preceding line from beneath tooth to dorsum; an indistinct, whitish, crenulate, subterminal line; an interrupted terminal line thickened between veins; cilia whitish with an interrupted, fuscous antemedian line. Hindwings with termen nearly straight, strongly dentate; as forewings, but without distinct lines, terminal line more uniform, cilia with a fuscous dot opposite each dentation. Underside more densely irrorated with fuscous; forewings with a single postmedian line; an incomplete, subterminal, fuscous band, in forewings not reaching costa, but forming a subcostal blotch, in hindwing forming a costal blotch.

Not near any Australian, but perhaps distantly related to some of the New Zealand species.

Rosebery in February; one specimen.

Lyelliana pristina, n.sp.

pristinus, primitive.

♂. 32-33 mm. Head whitish. Palpi 2; fuscous, at base and apex whitish. Antennæ grey; in ♂ with short pectinations (1½) extending to apex. Thorax whitish; apex of shoulder-flaps fuscous. Abdomen whitish. Legs fuscous; tibiæ and tarsi annulated with whitish; posterior pair mostly whitish. Forewings rather narrowly triangular, costa strongly arched from base to middle, thence straight, apex rounded-rectangular, termen slightly bowed, slightly oblique; 9 connected with 10 soon after its separation, 10 out of stalk of 7, 8, 9, 11 from cell, free; whitish suffused and irrorated with fuscous; a dark fuscous line from near base of costa not reaching middle; a suffused fuscous line from ¼ costa, at first outwardly oblique, angled inwards in middle, thence slender and inwardly oblique to 1/3 dorsum; a similar line from 3/8 costa, very oblique to beyond middle of disc, where it is angled inwards and continued as a series of dots to mid-dorsum; a line of dark fuscous dots from 2/3 costa to 2/3 dorsum, at first outwardly curved, sinuate, each dot is edged posteriorly by a whitish dot, above middle they are replaced by short longitudinal streaks between this and previous line; a dentate, whitish, subterminal line;

followed by some longitudinal, fuscous, interneural streaks; cilia grey barred with fuscous, apices whitish. Hindwings with termen rounded; pale-grey; a transverse, interrupted, fuscous postmedian line; an indistinct whitish subterminal line; cilia grey-whitish with incomplete fuscous bars. Underside grey-whitish; fuscous discal dots and postmedian dotted lines on both wings.

Cradle Mountain (3,000 ft.), in January; two specimens.

Amelora crenulata, n.sp.

crenulatus, scalloped.

♂ ♀. 30-36 mm. Head and thorax grey, sometimes brownish-tinged; face not projecting, with sparse rough hairs, which may form a slight tuft at inferior margin. Palpi in ♂ 1½, in ♀ 3; fuscous. Antennæ grey or brownish; pectinations in ♂ 6. Abdomen grey. Legs fuscous; tarsi annulated with whitish-ochreous; posterior pair grey. Forewings broadly triangular, costa moderately arched, more strongly so near base, apex rounded-rectangular, termen bowed, slightly oblique, crenulate; grey, sometimes brownish-tinged, with a few scattered blackish scales; an outwardly-curved line of blackish dots from 1/5 costa to ¼ dorsum, a blackish discal dot beneath midcosta; a subterminal line of angular blackish dots, slightly bisinuate, sometimes with whitish dots at their posterior ends, and in one example with these linked by a very fine, whitish, dentate line; cilia concolorous. Hindwings with termen slightly rounded, crenulate; pale-grey; sometimes a grey discal dot and subterminal line of dots; cilia grey. Underside similar, but markings less distinct on forewings, more distinct on hindwings.

The slight frontal tuft is easily denuded. Specimens from Russell Falls differ in being brownish-tinged, but are otherwise similar. The length of palpi is expressed in terms of breadth of eye, and this is smaller in the ♀.

Mt. Wellington (2,500 ft.), Russell Falls, Cradle Mountain (3,000 ft.); common in January. I have also an example from Mt. Kosciusko (5,000 ft.), New South Wales, in January.

Amelora suffusa, n.sp.

suffusus, blurred.

♂ ♀. 36-45 mm. Head and thorax pale-grey; face with a strong rounded projection, smooth except at lower edge, where are some rough scales, no definite tuft; upper

part of face sometimes fuscous. Palpi ♂ 2, ♀ 2½ to 3; grey-whitish with a very few fuscous scales. Antennæ pale-grey; pectinations in ♂ 5. Abdomen pale-grey. Legs grey-whitish with some fuscous irroration, more on anterior, less on posterior pair. Forewings triangular, costa arched near base, thence straight, apex rather sharply pointed, termen bowed, oblique, sinuate; grey, sometimes ochreous-tinted, with slight fuscous irroration; markings fuscous, suffused; a rather broad, outwardly-curved, slightly dentate line from ¼ costa to 1/3 dorsum; a suffused discal spot beneath mid-costa; a broad, acutely dentate, nearly straight line from 5/6 costa to 2/3 dorsum; cilia grey. Hindwings with termen gently rounded, wavy; pale-grey; cilia pale-grey. Underside pale-grey; forewings with a pale-fuscous discal spot; hindwings with a conspicuous discal spot and general sparse irroration dark-fuscous.

In one example the whole median area of forewing between the lines is suffused with fuscous.

Mt. Wellington (G. H. Hardy) and Lake Fenton (3,500 ft.), in January; eight specimens.

Amelora cyclocentra, n.sp.

κυκλοκεντρος, with central circle.

♂. 28-30 mm. Head grey-whitish; face without definite tuft. Palpi 2; grey. Antennæ grey-whitish; pectinations in ♂ 8. Thorax and abdomen grey-whitish with a few dark-fuscous scales. Legs fuscous; tarsi annulated with whitish; posterior pair mostly whitish; posterior tibiæ of ♂ dilated with internal groove and tuft. Forewings triangular, costa gently arched, apex rectangular, termen slightly bowed, slightly oblique, wavy; pale-grey, sometimes brownish-tinged, with more or less dark-fuscous irroration; a sub-basal series of three dark-fuscous dots, median dot posterior; a circular, median, fuscous discal spot, paler in centre; a postmedian series of dark fuscous dots, sometimes connected by a very fine whitish dentate line, from costa shortly before apex to 2/3 dorsum, the two submedian dots displaced outwards; a terminal series of dark-fuscous dots; cilia grey-whitish. Hindwings with termen rounded, wavy; pale-grey; a discal dot before middle and a postmedian transverse line of dots dark-grey; cilia pale-grey. Underside of forewings grey; along costa ochreous-whitish strigulated with fuscous; indistinct fuscous discal dot and postmedian line of dots; of

hindwings whitish, irrorated with fuscous; very distinct fuscous discal dot and postmedian line of dots.

Rosebery and Strahan, in February; two specimens (W. B. Barnard).

Amelora oxytona, n.sp.

ὀξυτονος, sharp.

♀. 30 mm. Head brown; face without definite tuft. Palpi 3; pale-grey, with a few darker scales. Antennæ pale-brownish, with some fuscous scales. Thorax brown. Abdomen grey, with some dark-fuscous irroration. Legs fuscous; tarsi with ochreous-whitish annulations; posterior pair paler. Forewings triangular, costa gently arched near base, thence straight, apex acute, slightly produced, termen sinuate, slightly oblique; brown, with some fuscous irroration; markings dark-fuscous; a very distinct, transverse line from 1/6 costa to 1/3 dorsum, outwardly curved with two strong posterior dentations; a suffused, indistinct, fuscous, median, discal spot; a very distinct line from 5/6 costa to ¾ dorsum, sharply dentate, bent somewhat inwards above middle; an indistinct terminal series of dots; cilia brown. Hindwings with termen rounded, wavy; grey-whitish; discal dot and a postmedian line of dots scarcely indicated; cilia grey-whitish. Underside of forewings grey, markings obsolete except indistinct dot and postmedian line; of hindwings whitish, with fuscous irroration, discal dot, and postmedian line of dots.

Rosebery in February; one specimen (W. B. Barnard).

Gen. ECPATITES, nov.

ἐκπατιτης, out of the beaten track.

Face with cone of rough hairs. Tongue well developed. Palpi long, porrect. Antennæ of ♂ bipectinate, extreme apex simple. Thorax [partly denuded, probably a triangular anterior crest will be found in more perfect examples] with a small bifid posterior crest; beneath somewhat hairy. Abdomen not crested. Femora hairy. Forewings in ♂ without fovea; 10 and 11 arising separately from cell, 11 anastomosing with 10 soon after origin, the stalk of 8, 9 anastomosing with 10, 11, all four veins arising by a common stalk from the double areole so formed, and separating in order, or 11 arising separately shortly before end of areole. Hindwings normal.

This looks like a *Chlenias*, but is distinguished by the peculiar neuration of the forewings, which superficially re-

sembles that of many *Larentiadæ* and *Oenochromidæ*, though probably an independent development.

Ecpatites callipolia, n.sp.

καλλιπολιος, beautifully grey.

♂. 40 mm. Head whitish-grey. Palpi 3; fuscous; base and upper edge whitish. Antennæ grey; pectinations in ♂ 5. Thorax whitish-grey; shoulders grey. Abdomen whitish. Legs fuscous; tarsi annulated with whitish; [posterior pair missing]. Forewings triangular, costa gently arched, apex round-pointed, termen bowed, slightly oblique, crenulate; grey, slightly brownish-tinged; a small brownish suffusion at base; a fine fuscous line from 1/5 costa to 1/3 dorsum, strongly angled outwards beneath costa, inwards in middle, and again outwards above dorsum; a more obscure, very fine, fuscous line from 2/5 costa to mid-dorsum; a dark-fuscous median discal dot, connected by a small white suffusion with a fine whitish line from 2/3 costa to 2/3 dorsum, angled inwards above dorsum; an oblique white streak from apex, not reaching middle; preceded by four short, longitudinal, fuscous-brown streaks; a dentate, whitish, transverse line from dorsum before tornus, preceded by a suffused brown line, which becomes fuscous towards dorsum, and succeeded by a suffused fuscous spot; an interrupted, dark-fuscous, terminal line connected by several fine lines with oblique streak from apex; grey-whitish, with some obscure fuscous bars. Hindwings broad, termen rounded, irregularly waved; grey-whitish; cilia whitish. Underside whitish-grey; with obscure fuscous discal dot and postmedian line on both wings; terminal area of forewings suffused with fuscous.

Rosebery in February; one specimen (W. B. Barnard).

Gen. ARCHEPHANES, nov.

ἀρχεφανης, conspicuous.

Face smooth, not projecting, without tuft, but with a few rough scales on lower edge. Tongue well developed. Palpi moderately long, porrect. Antennæ of ♂ thickened, dentate, minutely ciliated. Thorax with an erect posterior crest; beneath moderately hairy. Femora smooth. Posterior tibiæ of ♂ not dilated. Forewings in ♂ without fovea; 10 and 11 coincident, free, from cell. Hindwings with cell long (3/5); otherwise normal.

This and the following genus are probably allied to *Drymoptila*, Meyr.

Archephanes zalosema, n.sp.

ζαλοσημος, storm-marked.

♂ ♀. 34-38 mm. Head white; fillet black. Palpi 2; black; upper edge, base, and apex, white. Antennæ dark-fuscous; in ♂ dentate, apical 1/5 simple. Thorax white; a transverse antemedian line, two posterior dots, and posterior end of crest, black. Abdomen whitish, towards apex pale-grey. Legs fuscous; tarsi and anterior tibiæ annulated with white. Forewings rather narrowly triangular, costa gently arched, apex rounded-rectangular, termen relatively short, slightly bowed, slightly oblique; white, with intricate markings, and some irroration, black; a quadrangular, basal, costal spot connected by a broad oblique streak with dorsum near base; a similar costal spot shortly beyond connected with an irregular spot in disc giving off an oblique posterior process towards costa, and a broad line with an anterior tooth to 1/3 dorsum; this is followed by another spot or series of strigulæ on 1/3 costa; a median costal dot; a broad line from 2/3 costa towards tornus, below middle of disc bent abruptly inwards, and often irregularly blotched, thence wavy to 4/5 dorsum, preceded by a transverse dentate line from dorsum, usually connected in disc with anterior and posterior blotch; several spots or strigulæ on posterior part of costa; an irregular, broad, sometimes blotched, oblique streak from apex, sometimes interrupted; a terminal series of dots, of which one below middle is often larger and triangular; cilia white with black bars. Hindwings broad, termen rounded, slightly waved; whitish; with three, faint, postmedian, grey, transverse lines; cilia whitish with some grey bars. Underside of forewings fuscous; costa with white strigulæ; of hindwings as upperside but darker; a short, broad, transverse, dark-fuscous line, doubly edged with white, from costa before apex.

Mt. Wellington (4,000 ft.), Lake Fenton (3,500 ft.), and Cradle Mountain (3,000 ft.), in January; five specimens.

Gen. Hypsitropha, nov.

ὑψιτροφος, bred on the heights.

Head smooth, with a few projecting scales from lower edge. Tongue well-developed. Palpi moderate, porrect. Antennæ in ♂ slightly dentate, shortly ciliated. Thorax without crest; only slightly hairy beneath. Abdomen not crested. Femora smooth. Posterior tibiæ in ♂ not dilated. Forewings in ♂ without fovea; 10 and 11 arising separately from

cell, 10 sometimes connected with 9, 11 free. Hindwings normal.

Hypsitropha euschema, n.sp.

εὐσχημος, elegant.

♂. 30-32 mm. ♀. 26-30 mm. Head pale-brown. Palpi in ♂ 2¼, in ♀ 3; pale-brown. Antennæ grey; ciliations in ♂ ½. Thorax brown. Abdomen whitish, with a few fuscous scales. Legs brown, mixed with fuscous. Forewings triangular, costa slightly arched near base, thence nearly straight, apex pointed, termen slightly bowed, oblique; whitish, unequally suffused with brown, and sparsely irrorated with fuscous; a blackish line from 1/5 dorsum very obliquely outwards, bent outwards beneath middle of disc, ending shortly above middle; a conspicuous, blackish, discal dot beyond middle; a conspicuous, finely crenulate, blackish line from costa before apex to dorsum before tornus, doubly sinuate, being bent outwards in middle, inwards above and below middle, edged posteriorly with whitish; a fine, interrupted, dark-fuscous, terminal line; cilia whitish, more or less mixed with fuscous. Hindwings rather narrow, termen rounded; whitish; an indistinct pale-fuscous discal dot, and finely dentate postmedian line from ¾ dorsum; sometimes pale-fuscous transverse strigulæ in terminal area; a pale-fuscous terminal line; cilia as forewings. Underside pale-fuscous; forewings with costal edge brown, strigulated with fuscous; sometimes a darker discal dot, and a short, whitish, subterminal line from costa; hindwings as upper side, but irrorated or strigulated with fuscous, and markings more distinct.

Mt. Wellington (2,500 ft.), Lake Fenton (3,500 ft.), and Cradle Mountain (3,000 ft.), in January; eight specimens.

Dirce oriplancta, n.sp.

ὀριπλαγκτος, mountain-ranging.

♂ ♀. 26-28 mm. Head and thorax dark-fuscous, with a few brownish hairs. Eyes small. Palpi moderate; fuscous mixed with whitish. Antennæ dark-fuscous; in ♂ thickened, ciliations very minute. Abdomen dark-fuscous; apices of segments narrowly whitish. Legs fuscous; tarsi narrowly annulated with whitish. Forewings rather narrowly triangular, costa nearly straight, apex round-pointed, termen slightly bowed, scarcely oblique; fuscous mixed with reddish-brown and whitish; a darker basal patch partly edged with

whitish, a dentate whitish line, edged posteriorly with fuscous, from 1/3 costa to 1/3 dorsum; a fine, indistinct, median, fuscous, transverse line; a sinuate, wavy, white line, edged anteriorly with fuscous, from 2/3 costa to 2/3 dorsum; a white, doubly sinuate, crenulate, subterminal line; a submarginal series of fuscous spots; cilia fuscous, bases irrorated with reddish-brown, apices sharply barred with whitish. Hindwings with termen gently rounded; fuscous; sometimes a whitish central suffusion; cilia fuscous, apices whitish. Underside of forewings fuscous, with whitish discal suffusion, and a short, subterminal, whitish line from costa; of hindwings fuscous, with broad median, postmedian, and subterminal, transverse, whitish lines.

Lake Fenton (3,500 ft.), in January; five specimens, but all except one ♀ (which I have made the type) much worn. The species should be sought a month earlier. It is similar to *D. lunaris*, but without the large, white, sharply-defined blotch on hindwing.

Fam. ŒNOCHROMIDÆ.

Dichromodes diasemaria.

Dichromodes diasemaria, Gn. ix., p. 321.

Panagra exsignata, Wlk. xxiii., p. 1010, *nec* Meyr. P.L.S. N.S.W., 1889, p. 1178.

♂ ♀. 29-32 mm. Head and thorax fuscous. Palpi 3; fuscous; base sharply white. Antennæ fuscous; pectinations in ♂ 3½, apical 1/5 simple. Abdomen dark-grey. Legs fuscous; tarsi with slender whitish annulations; posterior pair grey. Forewings triangular, costa slightly arched at base, thence straight, apex pointed, termen slightly bowed, slightly oblique, crenulate; fuscous-grey; markings dark-fuscous; a short, incomplete, transverse, sub-basal line from costa; a nearly straight line from ¼ costa to 1/3 dorsum, in ♀ partly suffused with brown; a transverse median, discal mark, sometimes pale-centred; a nearly straight, finely dentate line from 2/3 costa to 2/3 dorsum; in ♀ this is usually followed by a whitish-grey fascia; a suffused, doubly sinuate, subterminal line, in ♂ indistinct, in ♀ broad and conspicuous; a pale line follows this; a fine terminal line; cilia fuscous-grey. Hindwings with termen rounded, slightly crenulate; dark-grey, in ♀ often suffused with brownish; terminal line and cilia as forewings. Underside of forewings fuscous, markings obsolete; of hindwings whitish, with dense irroration, discal dot, and subterminal line fuscous.

There is distinct sexual diversity.

St. Helens, Cradle Mountain (3,000 ft.), Zeehan, Strahan,

Dichromodes phæostropha, n.sp.

φαιοστροφος, dark-banded.

♂ ♀. 28-30 mm. Head grey-whitish. Palpi in ♂ 2½, in ♀ 3; dark-fuscous; upper edge grey-whitish; base sharply white. Antennæ fuscous; pectinations in ♂ 4, apical ½ simple. Thorax grey-whitish, mixed with fuscous. Abdomen grey. Legs dark-fuscous, irrorated, and tarsi annulated with whitish. Forewings triangular, costa slightly arched at base, thence straight, apex rather sharply pointed, termen slightly bowed, slightly oblique, crenulate; grey-whitish with some fuscous irroration; a fuscous, transverse, sub-basal line; a second line from ¼ costa to 1/3 dorsum, similar, but often partly brown; a fuscous median band, darker towards dorsum, containing some brown streaks on veins; anterior edge from 1/3 costa to mid-dorsum, irregularly dentate; posterior edge from 2/3 costa to 2/3 dorsum, incurved above middle, strongly dentate between this and dorsum; an oblong, transverse, discal spot with paler centre in median band, and sometimes obscured by it; an irregular, transverse, fuscous fascia from 5/6 costa to 5/6 dorsum, thickened on and beneath costa, in middle, and on dorsum, preceded by a fine line partly brown, partly fuscous; a suffused fuscous submarginal line; a fine fuscous terminal line; cilia grey-whitish indistinctly barred with fuscous. Hindwings with termen rounded, slightly crenulate; grey; dorsal edge fuscous, barred with grey-whitish; several very obscure pale transverse lines in terminal area; terminal line and cilia as forewings. Underside of forewings grey, markings nearly obsolete; of hindwings whitish, with fuscous irroration, discal dot, and transverse lines.

Rosebery and Strahan in February; nine specimens, also one in Coll. Lyell from Beaconsfield.

Fam. ARCTIADÆ.

Caprimima sicciodes, Hmps.

Cat. Lep. Phal. Suppl., p. 611. Pl. 32, f. 36.

♂ ♀. 20-26 mm. Head and thorax whitish-ochreous. Palpi brown. Antennæ whitish-ochreous; ciliations in ♂ 1½. Abdomen pale-ochreous-grey; tuft whitish-brown. Legs fuscous; posterior pair whitish-ochreous. Forewings triangular, costa rather strongly arched, apex rounded, termen obliquely

rounded; whitish-ochreous slightly brownish-tinged; markings dark-fuscous; costal and median sub-basal spots; a costal spot at 1/6 with submedian spot beneath it; a costal spot at 1/3 giving rise to a thick transverse line, which below middle becomes slender and dentate, and runs to 1/3 dorsum; usually a discal dot, which may be larger and pale-centred, a costal spot before 2/3 giving rise to a fine dentate line, at first inwards, then strongly outwards beneath costa, then sinuate to 2/3 dorsum; a costal spot at ¾ giving rise to a line, which runs close and parallel to preceding; cilia whitish-ochreous, bases spotted with dark-fuscous. Hindwings with termen rounded, wavy; whitish-ochreous, with a pale-grey terminal band variably developed, or wholly grey; cilia ochreous-whitish, sometimes partly grey.

Mt. Wellington (2,500 ft.), Russell Falls, Launceston, and Moina (2,000 ft), in January; Strahan in February; abundant.

Thallarcha epiostola, n.sp.

ἠπιοστολος, softly robed.

♂. 23 mm. Head white; face grey. Palpi dark-fuscous. Antennæ dark-fuscous; in ♂ with short pectinations (1), each with a terminal bristle of equal length. Thorax white, with a transverse dark-fuscous bar before middle. Abdomen whitish, with a median dorsal series of fuscous spots; sides, tuft, and underside pale-ochreous. Legs pale-ochreous; anterior pair fuscous. Forewings triangular, costa moderately arched, apex rounded, termen nearly straight, oblique; white; a broad, fuscous, costal streak from base to ¼, where it terminates abruptly; two parallel, median, dentate, transverse lines, sharply indented anteriorly beneath costa, and more deeply in middle; a short, similar, parallel line from dorsum, not reaching middle; a fuscous dot on ¾ costa and a larger spot at apex; an interrupted submarginal fuscous line; a large, whitish-ochreous, suffused spot in disc at 2/3; a fuscous terminal line; cilia fuscous, on apex white, on tornus whitish-ochreous. Hindwings with termen rounded; whitish-ochreous; a fuscous discal dot towards costa; a fuscous terminal line from apex to middle; cilia whitish-ochreous.

Rather similar to *T. isophragma*, Meyr., but, among other differences, the costal streak is much shorter, and the antennal pectinations longer. In *isophragma* they are scarcely ½.

Launceston in January; one specimen (G. H. Hardy).

Gen. NESOTROPHA, nov.

νησοτροφος, island-bred.

Tongue short and weakly developed. Palpi rather short, slender, ascending. Antennæ of ♂ with a double row of long pectinations extending to apex. Posterior tibiæ with two pairs of spurs. Forewings with all veins present, 2 from near angle, 3 from angle, 7 free, 8, 9, 10 stalked, 11 from cell, free. Hindwings with all veins present, 3 and 4 approximated or connate at origin, 5, 6, 7 nearly equidistant and parallel.

Nesotropha pygmæodes, n.sp.

πυγμαιωδης, tiny.

♂. 16 mm. Head white. Palpi fuscous. Antennæ whitish; pectinations in ♂ 10, fuscous. Thorax and abdomen fuscous. Legs fuscous; posterior pair grey-whitish. Forewings suboblong, costa strongly arched, apex pointed, termen straight, oblique; white, irrorated and suffused with fuscous; two blackish discal dots at slightly beyond 1/3 and at 2/3; a basal suffusion extending on costa to 1/3; a suffused, moderately broad, median, transverse fascia; a second similar fascia from costa before apex to tornus; cilia fuscous. Hindwings rather elongate, termen rounded; dark-grey; cilia dark-grey.

A very small and obscurely marked species.

Cradle Mountain (3,000 feet), in January; two specimens (W. B. Barnard).

Gen. PHAOS.

Phaos, Wlk., Cat. Brit. Mus., iii., p. 627.

Head densely hairy. Tongue very short, aborted. Palpi short, hidden in dense hair. Thorax clothed with long hair above and beneath. Anterior tibiæ with a small terminal claw on inner side. Posterior tibiæ with middle spurs absent, or present and approximated to terminal spurs. Forewings without areole, 7, 8, 9, 10 stalked, 11 separate. Hindwings with 3, 4, 5 approximated at origin, or 4 and 5 connate or stalked, 12 anastomosing with cell to about 2/5.

Type, *P. interfixa*, Wlk. I cannot agree with Hampson in referring this species to the genus *Estigmene*. It appears more closely allied to the New Zealand genus *Metacrias*, which differs only in the presence of a small areole. As all the known examples of *Phaos* are of the male sex, it is probable that the females have the wings incompletely developed as in *Metacrias*. It is quite evident that the stalking of 4 and 5

of the hindwings, and the presence or absence of middle spurs, are not here of generic value.

Phaos interfixa.

Phaos interfixa, Wlk., Cat. Brit. Mus. iii., p. 627.

♂. 30-35 mm. Head dark-fuscous; face usually with a central whitish spot. Palpi dark-fuscous. Antennæ dark-fuscous; pectinations in ♂ 1½. Thorax dark-fuscous; anterior margin, and sometimes edge of shoulder-flaps, whitish. Abdomen dark-fuscous; with five rings on subapical segments, crimson above, whitish beneath; apices of tuft whitish. Legs whitish, mixed with fuscous; femora fuscous, on dorsal surface crimson; posterior tibiæ without middle spurs. Forewings elongate-triangular, costa straight, apex round-pointed, termen bowed, oblique; dark-fuscous; a crimson subcostal streak from base to ⅓, separated by a whitish line from costal edge, which is dark-fuscous; numerous whitish spots; a longitudinal series of three elongate spots from near base to ¾, slightly above middle; two elongate spots on fold between base and ½; an inwardly oblique line of four small spots from beneath last median spot to above ¾ dorsum; dorsum broadly dark-fuscous; a subterminal series of small spots, partly confluent with a series of short whitish streaks running into termen; cilia fuscous. Hindwings broad, termen gently rounded; 4 and 5 separate (10 examples) or stalked (one example); whitish or pale-ochreous; some fuscous suffusion at base, which sometimes extends over whole of disc, obscuring markings; a large roundish or oval dark-fuscous discal spot, its posterior edge sometimes produced to an angle; a dark-fuscous terminal band containing some marginal irroration or small suffused spots, whitish or pale-ochreous; cilia fuscous, mixed with whitish or pale-ochreous, wholly the latter on dorsum. Underside whitish or pale-ochreous; forewings with subcostal crimson streak broader, and reaching discal spot at 2/3; both wings with large discal spots and terminal band dark-fuscous; outer half of band on forewings barred with whitish; disc sometimes more or less suffused with fuscous.

Mt. Wellington, Cradle Mountain (3,000 ft.), in January; eleven specimens.

Walker's description certainly refers to this species. So, apparently, does that of Hampson, Cat. Lep. Phal. iii., p. 339, but his figure, Pl. 47, f. 18, is that of the following

species. There are three allied species, which may be easily distinguished as follows:—

Forewings with dorsum dark-fuscous .. .. *interfixa*

Forewings with dorsum orange-ochreous .. .. *acmena*

Forewings with dorsum with alternate bars of blackish and ochreous .. .. *aglaophara*

The third species is from Mt. Kosciusko, New South Wales, and a description of it is being published elsewhere.

Phaos acmena, n.sp.

ἀκμηνος, vigorous.

♂. 32-36 mm. Head dark-fuscous; face, except lateral margins, whitish. Palpi, bases dark-fuscous, apices whitish. Antennæ dark-fuscous; pectinations in ♂ 1½. Thorax dark-fuscous; anterior margin, a longitudinal median line, and edges of shoulder-flaps, whitish. Abdomen, dorsum crimson, with a broad median dark-fuscous band; underside whitish. Legs fuscous, mixed with whitish; femora crimson-ochreous; posterior tibiæ with middle spurs. Forewings elongate-triangular, costa straight, apex rounded, termen bowed, slightly oblique; whitish-ochreous; costal edge whitish-ochreous; a crimson subcostal streak from base to ⅓; dorsal edge orange-ochreous; an irregular, broad, dark-fuscous subdorsal line from base to tornus; a similar but more slender median line from base, deflected downwards beyond middle to above tornus; these are crossed by three transverse lines; first at ⅓, tolerably straight; second from beneath midcosta, at first curved outwards, then sinuate to above mid-dorsum, interrupted beneath costa by a short, broad, longitudinal orange streak; third from beneath ¾ costa to above ¾ dorsum, slightly sinuate, constricted or narrowly interrupted on veins; a large discal spot beneath midcosta, sometimes divided into three lobes; a terminal dark-fuscous band, barred by short whitish streaks; cilia dark-fuscous at bases, apices whitish. Hindwings broad, termen gently rounded; 4 and 5 stalked; orange-ochreous; some basal suffusion, a large discal spot, and a broad band along costa and termen, dark-fuscous; the terminal band is indented in middle, and contains one or two orange-ochreous spots; cilia with bases dark-fuscous, apices orange-ochreous. Underside orange-ochreous; both wings with dark-fuscous discal spot and terminal band; band on forewings contains a transverse orange-ochreous line, and three or four whitish bars beneath costa; band on hindwing

contains three orange-ochreous spots partly confluent on termen; basal subcostal streak on forewings very short.

Bothwell in February (W. B. Barnard); Launceston in February (F. M. Littler); six specimens.

Fam. NOLIDÆ.

Celama tholera, n.sp.

θολερος, muddy.

♀. 21 mm. Head and thorax white. Palpi 6; white, irrorated with fuscous. Antennæ pale-grey, toward base whitish. Abdomen whitish. Legs whitish; anterior pair irrorated with fuscous. Forewings triangular, costa gently arched, apex round-pointed, termen slightly bowed, oblique; fuscous-brown; basal area suffused with white; a broad median transverse fascia, edged posteriorly by an oblique white line from 5/6 costa to 2/3 dorsum; a very indistinct, wavy, whitish subterminal line; cilia fuscous-brown. Hindwings with termen slightly rounded; whitish; slightly suffused with grey on termen; cilia whitish, with slight grey suffusion around apex.

Wilmot in February; one specimen.

Nola macrorrhyncha, n.sp.

μακρορρύγκος, long-nosed.

♂ ♀. 26-28 mm. Head and thorax whitish, irrorated with grey. Palpi 8; grey, irrorated with whitish. Antennæ whitish; in ♂ bipectinate, apical 1/8 simple, pectinations 3. Abdomen whitish. Legs grey; posterior pair whitish. Forewings strongly dilated posteriorly, costa gently arched, apex round-pointed, termen slightly bowed, oblique; costal retinaculum of ♂ long, slender, bar-shaped; grey, with some whitish suffusion; subcostal tufts near base, at 1/3, and middle, the last nearer costa, anteriorly grey, posteriorly whitish; a short oblique, fuscous streak on costa at ¼; a similar streak on midcosta, giving rise to a postmedian line of short fuscous streaks on veins, at first outwardly oblique and indistinct beneath costa, thence outwardly curved, sinuate to mid-dorsum, indistinct towards dorsum; similar interneural streaks in posterior part of disc, and a third series running into termen; cilia grey. Hindwings with termen rounded; whitish; cilia whitish.

Hobart in March; Mt. Wellington in February; three specimens. Type in Coll. Lyell. The antennal structure of ♂ is a good distinguishing character.

Fam. NOCTUIDÆ.

Dasygaster pammacha, Turn.

♀. 40-48 mm. (The dimensions are incorrectly given in my description.) Forewings with a blackish median streak from base to ¼, sometimes included in a broad suffused dark-fuscous median band extending to termen; a strongly dentate, dark-fuscous, transverse line from ¼ costa to mid-dorsum, interrupted beneath costa; connected above and below interruption with a sharply dentate line from 3/5 costa to mid-dorsum; these transverse lines are obscured by the median band, when this is developed.

Lake Fenton (3,500 ft.) and Cradle Mountain (3,000 ft.), in January.

Euplexia calliphæa, n.sp.

καλλιφαιος, beautifully dark.

♂ ♀. 44-46 mm. Head and thorax blackish, with a few white scales; white spots encircling bases of antennæ. Palpi 1½; blackish mixed with white. Antennæ blackish. Abdomen dark-fuscous. Legs dark-fuscous; posterior pair irrorated, and all tarsi annulated with whitish. Forewings triangular, costa slightly arched, apex round-pointed, termen bowed, oblique, crenulate; blackish, with a few scattered white scales; orbicular very slenderly outlined with white, broadly and transversely oval; reniform oblong, white with included blackish dots, anterior and posterior margins defined with white, upper and lower margins open, two short white streaks on veins from its posterior inferior angle; three equidistant white dots on posterior fourth of costa; some subterminal white irroration, forming suffused spots beneath apex and below middle; cilia blackish, bases, apices, and narrow bars opposite veins ochreous-whitish. Hindwings with termen gently rounded, crenulate; fuscous; cilia fuscous. Underside fuscous; forewings with a whitish dot in disc at 2/3; hindwings suffused with whitish, except a discal spot, and broad terminal band.

Bothwell and Moina (2,000 ft.), in January; two specimens.

Fam. ANTHELIDÆ.

Anthela pyrrhobaphes, n.sp.

πυρρόβαφης, suffused with red.

♂. 36-40 mm. ♀. 43-44 mm. Head and palpi dark-reddish. Antennæ white; pectinations ochreous-fuscous.

Thorax ochreous-reddish. Abdomen reddish. Legs reddish; tarsi ochreous-whitish. Forewings triangular, costa straight, apex sharply pointed, termen straight in apical half, thence rounded; dark-reddish; markings fuscous; a discal spot beyond middle with whitish centre; antemedian line obsolete, just traceable near dorsum; postmedian distinct, rather broadly suffused, from 4/5 costa to 2/3 dorsum; a more slender, curved, subterminal line; cilia reddish. Hindwings with termen slightly rounded; as forewings, but discal spot indistinct. Underside similar; discal spot of hindwings distinct in ♂, beneath costa at about middle, white-centred.

More dusky than *A. ferruginosa*, and with quite differently shaped forewings in the ♂. In that species costa and dorsum of ♂ forewings are of nearly equal length, in this dorsum is about 2/3.

Zeehan in February; four specimens.

Anthela phæozona, n.sp.

φαιοζωνος, dark-girdled.

♀. 68 mm. Head ochreous-grey. Thorax grey, anteriorly ochreous-tinged. Abdomen grey. Forewings triangular, costa straight, apex pointed, produced, termen strongly sinuate, oblique; grey; a fuscous line from ¼ to 1/3 dorsum, outwardly curved, indented posteriorly beneath costa; a broadly suffused brownish-fuscous, outwardly-curved line from costa before middle, joining first line on dorsum; discal spots before and after middle, finely outlined with fuscous, pale-centred; a broad postmedian fuscous fascia from ¾ costa to ¾ dorsum, its anterior edge sinuate, an included pale line near and parallel to this edge, posterior edge slightly outwardly-curved, strongly crenulate; cilia grey, apices ochreous-tinged. Hindwings with termen rounded; as forewings, but without discal spots. Underside ochreous-grey; forewings with two, hindwings with one discal spot, both wings with postmedian and fine, crenulate, subterminal fuscous lines.

Bothwell in March; one specimen (W. B. Barnard).

Fam. ZYGÆNIDÆ.

Pollanisus calliceros, n.sp.

καλλικερως, with beautiful horns.

♂. 16-20 mm. Head, thorax, and abdomen shining metallic green or bluish-green. Palpi fuscous. Antennal

stalk green or bluish-green; pectinations in ♂ 8, clubbed, fuscous. Legs fuscous, more or less suffused with green lustre. Forewings obovate, broadening towards termen, apex very obtusely rounded; shining metallic green or bluish-green; cilia fuscous. Hindwings moderately broad, apex very obtusely rounded; 3 and 4 separate; fuscous; cilia fuscous.

Easily recognised by the short rounded forewings and ♂ antennæ. The ♀ must be very retired in its habits, for I have never seen one.

Moina (2,000 ft.), in January; seven specimens. Also from Ebor (4,000 ft.), New South Wales, in January and February; twelve specimens.

Fam. CRAMBIDÆ.

Talis invalidella, Meyr.

I now consider that *T. eucraspeda*, Turn., is a synonym. The species varies considerably in the detailed development of the markings on the forewings, and Meyrick's description was taken from a single Tasmanian example. The species has a wide range.

Hobart; one specimen in January. Also from Geelong, Gisborne, and Dunkeld, Victoria; Glen Innes, New South Wales; and Warwick, Queensland.

Talis orthotypa, Turn.

Palpi extremely long (7 or 8); pale-fuscous, lower edge in basal half whitish.

Lake Fenton (3,500 ft.) and Moina (2,000 ft.), in January; Rosebery and Strahan in February; seven specimens. Described from a single specimen without palpi from Katoomba, New South Wales.

Fam. PYRALIDÆ.

Catamola tholoëssa, n.sp.

θολοεις, turbid.

♂. 22 mm. Head fuscous. Palpi of ♂ ascending, closely applied to frons, well exceeding vertex, second joint not dilated; fuscous. Antennæ fuscous; in ♂ with short basal process, not reaching middle of thorax, ciliations ½. Thorax and abdomen fuscous. Legs fuscous; posterior pair fuscous-whitish. Forewings triangular, costa moderately arched, apex

round-pointed, termen bowed, oblique; in ♂ with a small glandular thickening on costa at about 3/5; fuscous; darker antemedian and postmedian transverse lines; cilia whitish, mixed with fuscous. Hindwings with termen rounded; pale fuscous; cilia fuscous-whitish.

Owing to the poor condition of the type, which is in Coll. Lyell, the description of the wing-markings is loosely drawn, but the species should be easily recognised by the small glandular thickening on costa of forewing.

Hobart in March; one specimen.

Epipaschia amauropis, n.sp.

ἀμαυρωπις, obscure.

♀. 30 mm. Head and thorax brown. Palpi ascending, 4, second joint very long, much exceeding vertex, terminal joint very short; brown mixed with dark fuscous. Antennæ fuscous. Abdomen grey-whitish. Legs fuscous; tarsi with whitish annulations; posterior pair except tarsi whitish, irrorated with reddish and dark-fuscous. Forewings elongate-triangular, costa slightly arched, apex rounded-rectangular, termen bowed, slightly oblique; pale reddish-brown, mixed with whitish; a reddish-brown and fuscous discal dot beneath midcosta; an antemedian transverse line at ⅓, straight indistinct; postmedian line very slender, whitish, finely dentate, from 2/3 costa obliquely outwards, forming a quadrate, median, posterior projection, thence bent inwards to ¾ dorsum, an interrupted, fuscous terminal line; cilia whitish, mixed with reddish, with some incomplete fuscous bars. Hindwings with termen rounded; whitish-grey, darker towards termen; cilia whitish with an antemedian fuscous line.

Strahan in February; one specimen.

Fam. PYRAUSTIDÆ.

Scoparia plagiotis, Meyr.

♂ ♀. 22-25 mm. This species varies much in the development of blackish streaks on the forewings. *S. ochrophara*, Turn., is a form, found also in Tasmania, in which these are well developed, and the reniform is obscured by a blackish streak or small blotch.

Hobart, Bothwell, Campbell Town, Wilmot, Moina (2,000 ft.), Rosebery, Zeehan, Strahan. Also from Mt. Kosciusko (3,000 to 3,500 ft.), New South Wales (type *ochrophara*); and Gisborne, Victoria.

A REVISION OF THE LEPIDOPTERA OF TASMANIA.

By

A. Jefferis Turner, M.D., F.E.S., Brisbane.

(Read 12th October, 1925.)

Tasmania is rich in Lepidoptera. The species are numerous, very interesting, but have been very little studied. There is a great want of resident collectors and observers, and it is to encourage these that this revision has been planned. The classification adopted is that used in Dr. Tillyard's recent book. It is a revision of species only; no notice is taken of local races (usually, but unfortunately, called subspecies). To each genus and species is added the name of its author. Synonyms are excluded, and after each species there is given a single reference, not necessarily to the original description, but to the best available description for the local student. On reference to this, the synonymy and other particulars will usually be found. Where this description appears under another name, that name is added in brackets. Genera and species which have not been recorded outside Tasmania are distinguished by a *. These restrictions have been necessary to secure brevity. Should this revision accomplish its purpose it will soon become obsolete, but a list of additions may be published subsequently. To this end, I shall be pleased to correspond with and name specimens for local collectors. Only the first half of the revision is published this year; we hope to complete the second half in next year's Proceedings.

For our species and localities we are indebted to various sources. The most considerable is the papers of Mr. Edw. Meyrick, F.R.S., who collected extensively in the island during the summer of 1882-83. His localities were Hobart, Mount Wellington, Campbell Town, George's Bay (St. Helens), Launceston, and Deloraine. Next to this in importance are the results of a six weeks' tour in January and February,

1925, mainly devoted to the mountains and west coast, by Mr. W. B. Barnard, of Toowoomba, Queensland, and myself, the localities being Hobart, Mount Wellington, Russell Falls and Lake Fenton (3,500 ft.), in the National Park, Launceston, Wilmot, Moina (2,000 ft., on the Cradle Mountain Road, 17 miles from Wilmot, and near the small mining township of that name), Cradle Mountain (3,000 ft.), Burnie, Rosebery (17 miles north of Zeehan), Zeehan, and Strahan. After my departure Mr. Barnard collected for a few weeks in Launceston, near Beaconsfield, Ross, and Bothwell. Among resident collectors we may mention H. H. Griffith, J. B. Norman (Strahan), W. K. Findlay (Zeehan), G. J. Latta (Launceston), A. M. Lea (Hobart), Mrs. Lodder (Ulverstone), and G. H. Hardy (Hobart). On a larger scale was F. M. Littler's collection, now in the South Australian Museum, to the trustees of which and to Mr. N. B. Tindale I am much indebted for a list of species and localities and the loan of some specimens for examination. Littler's localities were Launceston, Beaconsfield (Kelso), George Town (Lefroy), St. Mary's, and St. Helens. Our locality records are, of course, very far from exhaustive. A species recorded from one locality may be expected to occur in any other with similar vegetation, altitude, rainfall, etc. Species recorded from three or more localities are probably generally distributed. Where no locality is given the species has been recorded simply from Tasmania.

A general discussion of the fauna would be impossible in this place, but a few observations may be allowed. Tasmania was united to the mainland during the lifetime of existing species in Pleistocene times. A period of glaciation, which occurred during this connection, covered the mountains with snowfields, while the lower areas supported a fauna which has since then been restricted to alpine regions. In this way we explain the occurrence of a number of identical species in the widely separated areas of Cradle Mountain and the Australian Alps. Much of the old Tasmanian fauna, not able to withstand these rigorous conditions, must have been driven northwards, to return with the resumption of a milder climate, probably with some impoverishment, which was compensated by a large immigration of Australian forms. The whole fauna is now preponderatingly Australian, but a relatively small proportion of peculiarly Tasmanian forms still survive, mostly in the mountains.

The following is a list of contractions employed in the references:—

Ann. Mag. Nat. Hist.	Annals and Magazine of Natural History.
Brit. Lep.	Meyrick. Handbook of British Lepidoptera.
Cat. Brit. Mus.	Walker. List of Lepidopterous Insects in British Museum.
Cat. Lep. Phal.	Hampson. Catalogue of the Lepidoptera Phalænæ.
Delt. & Pyr.	Guenée. Deltoides et Pyralites.
Exot. Micro.	Meyrick. Exotic Microlepidoptera.
Noct.	Guenée. Noctuélites.
Prodr. Zool. Vic.	McCoy. Prodromus to Zoology of Victoria.
P.L.S.N.S.W.	Proceedings of the Linnean Society of New South Wales.
P.R.S.Q.	Proceedings of the Royal Society of Queensland.
P.R.S. Tas.	Proceedings of the Royal Society of Tasmania.
P.R.S. Vic.	Proceedings of the Royal Society of Victoria.
P. Zool. Soc.	Proceedings of the Zoological Society of London.
Tr. E.S.	Transactions of the Entomological Society of London.
Tr. N.Z. Inst.	Transactions of the New Zealand Institute.
Tr. R.S.S.A.	Transactions of the Royal Society of South Australia.
W. & L.	Waterhouse and Lyell. The Butterflies of Australia.

LEPIDOPTERA HETERONEURA.

RHOPALOCERA.

NYMPHALOIDEA.

LYCÆNIDÆ.

Lycæninæ.

Candalides, Hb.

acasta, Cox. W. & L., p. 81. Hobart; Beaconsfield; Strahan.

Zizina, Chapman.

labradus, Godart. W. & L., p. 105. Hobart; Bothwell; Launceston; Beaconsfield.

Neolucia, W. & L.

agricola, Westw. W. & L., p. 107. Hobart; Mt. Wellington; Russell Falls; Launceston; Waratah; Zeehan; Strahan.

hobartensis, Miskin. W. & L., p. 108. Mt. Wellington, 4,000 ft.; Moina, 2,000 ft.; Middlesex Plains, 2,500 ft.; Cradle Mt., 3,000 ft.

mathewi, Miskin. W. & L., p. 108. Flinders Island.

Theclinæ.

Paralucia, W. & L.

aurifer, Blanchard. W. & L., p. 112. Hobart; Launceston; George Town; St. Mary's.

Pseudalmenus, Druce.

chlorinda, Blanchard. W. & L., p. 113. Hobart; Launceston.

[PIERIDIDÆ. Several examples of *Anaphæis java*, Sparrman, and at least one of *Appias paulina*, Cram., both common Australian species, have been taken on the north coast of Tasmania. These appear to be casual immigrants, either on their own wings assisted by northerly winds, or conveyed on steamers, and not genuine residents.]

NYMPHALIDÆ.

Satyrinæ.

Heteronympha, Wlgrn.

merope, Fab. W. & L., p. 37. Hobart, Launceston; Beaconsfield; Burnie; Flinders Island.

philerope, Bdv. W. & L., p. 39. Hobart; Ross; Launceston; Moina, 2,000 ft.; Burnie; Mt. Magnet.

cordace, Hb. W. & L., p. 40. Moina, 2,000 ft.; Zeehan; Strahan.

**Nesoxenica*, W. & L.

**leprea*, Hew. W. & L., p. 35. Mt. Wellington, 2,500 ft.; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.; Mt. Dundas; Mt. Magnet.

Arginnina, Butl.

**hobartia*, Westw. W. & L., p. 40. Hobart; Mt. Wellington; Launceston; Latrobe.

**tasmanica*, Lyell. W. & L., p. 41. Zeehan; Strahan.

Oreixenica, W. & L.

lathoniella, Westw. W. & L., p. 42. Hobart; Mt. Wellington; Bothwell; Launceston; Beaconsfield; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.; Ulverstone; Burnie; Mt. Magnet.

**laranda*, W. & L. W. & L., p. 42. Zeehan; Strahan; Mt. Magnet.

orichora, Meyr. W. & L., p. 43. Middlesex Plains, 2,500 ft.; Cradle Mt., 3,000 ft.

Xenica, Westw.

klugi, Guerin. W. & L., p. 44. Hobart; Russell Falls; Brighton; Bothwell; Launceston; Beaconsfield; George Town; Sheffield; Burnie; Rosebery; Zeehan; Strahan.

Nymphalinæ.

Precis, Hb.

villida, Fab. W. & L., p. 54. Launceston; George Town; Burnie.

Pyrameis, Hb.

cardui, Lin. W. & L., p. 56. Launceston; St. Mary's; Zeehan.

itea, Fab. W. & L., p. 56. Bothwell; Lottah; Launceston; Burnie; Mt. Magnet.

PAPILIONOIDEA.

Papilionidæ.

Papilio, Lin.

macleayanus, Leach. W. & L., p. 166. Hobart; Launceston; Mt. Magnet.

HESPEROIDEA.

Hesperidæ.

Trapezetinæ.

Anisynta, Low.

eticna, Hew. W. & L., p. 176. Hobart; Deloraine.

lutea, Tepper. W. & L., p. 177. Hobart; Launceston; George Town.

tasmanica, Miskin. W. & L., p. 183. Hobart; Bagdad; Launceston; Beaconsfield; George Town; Mt. Magnet.

Hesperilla, Hew.

chaostola, Meyr. W. & L., p. 187. Hobart; Huonville; Bridport.

donnysa, Hew. W. & L., p. 188. Hobart; Mt. Wellington; Cygnet; Scottsdale; Cradle Mt., 3,000 ft.; Mt. Magnet; Zeehan; Strahan.

idothea, Miskin. W. & L., p. 187. Hobart; Geeveston; Scottsdale; Strahan.

cyclospila, M. & L. W. & L., p. 188. Bridport; Latrobe.

Motasingha, Watson.

dominula, Ploetz. W. & L., p. 197. Bothwell; Ross; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.; Mt. Magnet; Strahan.

Erynninæ.

Taractrocera, Butl.

papyria, Bdv. W. & L., p. 200. Hobart; Triabunna; Rosebery; Strahan.

Padraona, Moore.

lascivia, Rosen. W. & L., p. 202. Hobart.

flavovittata, Latr. W. & L., p. 203. Hobart; Triabunna; Launceston; Wynyard.

HETEROCERA.

BOMBYCOIDEA.

Saturniadæ.

Antheræa, Hb.

eucalypti, Scott. P.L.S.N.S.W. 1922, p. 355.

helena, White. P.L.S.N.S.W. 1922, p. 355. Launceston.

NOTODONTOIDEA.

Larentiadæ.

Euchœca, Hb.

rubropunctaria, Dbld. P.L.S.N.S.W. 1890, p. 811. Hobart; Mt. Wellington; Russell Falls; St. Helens; Launceston.

Pœcilasthena, Warr.

pulchraria, Dbld. P.L.S.N.S.W. 1890, p. 813. Hobart; Mt. Wellington, 2,500 ft.; Tasman Peninsula; St. Helens; Deloraine; Cradle Mt., 3,000 ft.; Burnie.

urarcha, Meyr. P.L.S.N.S.W. 1890, p. 812. Mt. Wellington, 2,500 ft.; Deloraine.

**euphylla*, Meyr. P.L.S.N.S.W. 1890, p. 815. Hobart; Mt. Wellington, 2,500 ft.; Deloraine.

anthodes, Meyr. P.L.S.N.S.W. 1890, p. 816. Rosebery.

**ædœa*, Turn. P.R.S. Tas. 1925. Rosebery; Strahan.

xylocyma, Meyr. P.L.S.N.S.W. 1890, p. 814. Mt. Wellington, 2,500 ft.; Russell Falls.

Chloroclystis, Hb.

catastreptes, Meyr. P.L.S.N.S.W., 1890, p. 797. Launceston.

testulata, Gn. P.L.S.N.S.W. 1890, p. 798. Hobart; Mt. Wellington, 2,500 ft.; St. Helens; Deloraine.

approximata, Wlk. P.L.S.N.S.W. 1890, p. 799 (*pyretodes*). St. Helens.

laticostata, Wlk. P.L.S.N.S.W. 1890, p. 801. Hobart; Launceston.

filata, Gn. P.L.S.N.S.W. 1890, p. 795. Hobart; Mt. Wellington, 2,500 ft.; Lake Fenton, 3,500 ft.; Launceston; Deloraine; Strahan.

Chætolopha, Warr.

leucophragma, Meyr. P.L.S.N.S.W. 1890, p. 818. Russell Falls; Launceston; Wilmot; Moina, 2,000 ft.; Burnie.

Microdes, Gn.

villosata, Gn. P.L.S.N.S.W. 1890, p. 802. Hobart; Mt. Wellington, 2,500 ft.; Russell Falls; Lake Fenton, 3,500ft.; Launceston; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.; Strahan.

squamulata, Gn. P.L.S.N.S.W. 1890, p. 803. Hobart; Russell Falls; Bothwell; Launceston.

**hæmobaphes*, Turn. P.R.S. Tas. 1925. Lake Fenton, 3,500 ft.

typhopa, Low. Tr. R.S.S.A. 1897, p. 50.

**melanocausta*, Meyr. P.L.S.N.S.W. 1890, p. 803. Mt. Wellington, 2,500 ft.; Deloraine.

**diplodonta*, Turn. P.R.S. Vic. 1903, p. 239. Mt. Wellington, 2,500 ft.

Eccymatoge, Prout.

callizona, Low. P.L.S.N.S.W. 1890, p. 855 (*brujata*). Mt. Wellington, 2,500 ft.; Russell Falls; Beaconsfield.

**iopolia*, Turn. P.R.S. Tas. 1925. Cradle Mt., 3,000 ft.

Horisme, Hb.

mortuata, Gn. P.L.S.N.S.W. 1890, p. 853. Hobart; St. Helens.

leucophanes, Meyr. P.R.S. Tas. 1925. Mt. Wellington, 2,500 ft.; Lake Fenton, 3,500 ft; St. Helens; Beaconsfield; Deloraine; Rosebery; Strahan.

Eucymatoge, Hb.

**liometopa*, Turn. P.R.S. Tas. 1925. Russell Falls.

Cidaria, Treit.

apotoma, Turn. P.L.S.N.S.W. 1906, p. 706.

uncinata, Gn. P.L.S.N.S.W. 1890, p. 850. Hobart; St. Helens; Launceston; Beaconsfield; Strahan.

microcyma, Meyr. P.L.S.N.S.W. 1890, p. 846. Tasman Peninsula; Campbell Town; St. Helens.

subochraria, Dbld. P.L.S.N.S.W. 1890, p. 851. Hobart; Bothwell; St. Helens; Launceston; Deloraine; Sheffield; Rosebery; Strahan.

Larentia, Treit.

epicrossa, Meyr. P.L.S.N.S.W. 1890, p. 871. Mt. Wellington; Deloraine; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.; Rosebery; Zeehan; Strahan.

cheimatobiata, Gn. P.R.S. Vic. 1903, p. 274. Hobart; Mt. Wellington; Brighton; Moina, 2,000 ft.

Epirrhoë, Hb.

**eustropha*, Turn. P.R.S. Tas. 1925. Mt. Wellington, 2,500 ft.

**callima*, Turn. P.R.S. Tas. 1925. Cradle Mt., 3,000 ft.; Strahan.

Melitulias, Meyr.

graphicata, Meyr. P.L.S.N.S.W. 1890, p. 857. Tasman Peninsula; Bridport; Launceston; Beaconsfield; Deloraine; Ulverstone; Cradle Mt., 3,000 ft.; Rosebery; Zeehan; Strahan.

leucographa, Turn. Tr. R.S.S.A. 1922, p. 247. Lake Fenton, 3,500 ft.

glandulata, Gn. P.L.S.N.S.W. 1890, p. 858. Hobart; Mt. Wellington; Bothwell; Swansea; St. Helens; Moina, 2,000 ft.; Strahan.

Euphyia, Hb.

interruptata, Gn. P.L.S.N.S.W. 1890, p. 825. Moina, 2,000 ft.; Cradle Mt., 3,000 ft.

epicteta, Turn. P.L.S.N.S.W. 1907, p. 633. Mt. Wellington, 2,500 ft.; Russell Falls; Launceston; Wilmot; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.; Rosebery; Strahan.

**psarodes*, Turn. P.R.S. Vic. 1903, p. 253. Mt. Wellington, 2,500 ft.; Lake Fenton, 3,500 ft.; Cradle Mt., 3,000 ft.; Strahan.

lucidulata, Wlk. P.L.S.N.S.W. 1890, p. 827. Tasman Peninsula; Launceston; Deloraine; Wilmot; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.; Rosebery; Zeehan; Strahan.

conifasciata, Butl. P.L.S.N.S.W. 1890, p. 828. Hobart; Mt. Wellington, 2,500 ft.; Russell Falls; Sheffield; Wilmot; Moina, 2,000ft.; Rosebery; Zeehan.

percrassata, Wlk. P.L.S.N.S.W. 1890, p. 873. Ross.

subrectaria, Gn. P.L.S.N.S.W. 1890, p. 829. Bothwell; Launceston.

lamprotis, Meyr. P.L.S.N.S.W. 1890, p. 833. Bothwell.

anthracinata, Gn. P.L.S.N.S.W. 1890, p. 830. Hobart; Mt. Wellington, 2,500ft.; Russell Falls; Bothwell; Campbell Town; Launceston; Wilmot; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.; Latrobe; Burnie; Strahan.

strumosata, Gn. P.L.S.N.S.W. 1890, p. 831. Hobart; Mt. Wellington, 2,500 ft.; Russell Falls; St. Helens; Launceston; Deloraine; Cradle Mt., 3,000 ft.; Guildford; Rosebery; Zeehan; Strahan.

vacuaria, Gn. P.L.S.N.S.W. 1890, p. 866. Hobart; Launceston; Beaconsfield.

leptophrica, Turn. Tr. R.S.S.A. 1922, p. 250. Bothwell; Moina, 2,000 ft.

**hilaodes*, Turn. P.R.S. Tas. 1925. Russell Falls; Moina, 2,000 ft.; Rosebery.

**synchora*, Meyr. P.L.S.N.S.W. 1890, p. 835. Hobart.

heteroleuca, Meyr. P.L.S.N.S.W. 1890, p. 837.

excentrata, Gn. P.L.S.N.S.W. 1890, p. 834 (*constipata*).

**heterotropa*, Turn. P.R.S. Tas. 1925. Mt. Wellington, 2,500 ft.; Moina, 2,000 ft.; Middlesex Plains, 2,500 ft.; Cradle Mt., 3,000 ft.

languescens, Rosen. P.L.S.N.S.W. 1890, p. 839. Hobart; Mt. Wellington; Wilmot.

orthropis, Meyr. P.L.S.N.S.W. 1890, p. 840. Mt. Wellington, 2,500 ft.; Cradle Mt., 3,000 ft.

**trissophrica*, Turn. P.R.S. Vic. 1903, p. 259. Mt. Wellington.

chrysocyma, Meyr. P.L.S.N.S.W. 1890, p. 843. Middlesex Plains, 2,500 ft.; Cradle Mt., 3,000 ft.

perornata, Wlk. P.L.S.N.S.W. 1890, p. 844. Mt. Wellington; Bothwell; Moina, 2,000 ft.; Beaconsfield; Cradle Mt., 3,000 ft.; Zeehan.

mecynata, Gn. P.L.S.N.S.W. 1890, p. 845. Hobart; Bothwell; St. Mary's; Launceston; Deloraine.

leucozona, Meyr. P.L.S.N.S.W. 1890, p. 846. Bothwell; Launceston; Deloraine.

cbuleata, Gn. P.L.S.N.S.W. 1890, p. 849. Hobart; Russell Falls; Campbell Town; Launceston; Deloraine; Wilmot; Moina, 2,000 ft.

correlata, Wlk. P.L.S.N.S.W. 1890, p. 848. Russell Falls; Launceston; Wilmot; Cradle Mt., 3,000 ft.

trygodes, Meyr. P.L.S.N.S.W. 1890, p. 851. St. Helens; Launceston; Rosebery; Strahan.

crocota, Turn. P.R.S. Vic. 1903, p. 263. Hobart.

plagiocausta, Turn. P.R.S. Vic. 1903, p. 263. Hobart.

severata, Gn. P.L.S.N.S.W. 1890, p. 854. Hobart; Russell Falls; Campbell Town; St. Helens; Launceston; Cradle Mt., 3,000ft.

squamulata, Warr. P.R.S. Vic. 1903, p. 264. Hobart.

**Aprosdoceta*, Turn.

**orina*, Turn. P.R.S. Tas. 1925. Lake Fenton, 3,500 ft.

**chytrodes*, Turn. P.R.S. Tas. 1925. Lake Fenton, 3,500 ft.

Acodia, Rosen.

pauper, Rosen. P.L.S.N.S.W. 1890, p. 861. Hobart; Mt. Wellington; Russell Falls; Ulverstone.

Xanthorhoë, Hb.

**centroneura*, Meyr. P.L.S.N.S.W. 1890, p. 863. Hobart; Moina, 2,000 ft.

subidaria, Gn. P.L.S.N.S.W. 1890, p. 864. Hobart; Mt. Wellington, 2,500 ft.; Russell Falls; Bothwell; St. Helens; Beaconsfield; Launceston; George Town; Wilmot; Cradle Mt., 3,000 ft.; Burnie; Rosebery; Strahan.

sodaliata, Wlk. Tr. R.S.S.A. 1922, p. 254. Hobart; Launceston.

**bituminea*, Turn. P.R.S. Tas. 1925. Rosebery.

**pyrrhobaphes*, Turn. P.R.S. Tas. 1925. Moina, 2,000 ft.

**amblychroa*, Turn. P.R.S. Tas. 1925. Hobart.

agelasta, Turn. P.R.S. Vic. 1903, p. 270. Launceston.

hyperythra, Low. Tr. R.S.S.A. 1892, p. 12. Wilmot.

brujata, Gn. P.L.S.N.S.W. 1890, p. 868 (*repentinata*). Bothwell; Ulverstone; Burnie.

anaspila, Meyr. P.L.S.N.S.W. 1890, p. 869. Mt. Wellington, 2,500 ft.; Russell Falls; Bothwell; Moina, 2,000 ft.

heliacaria, Gn. P.L.S.N.S.W. 1890, p. 872. Hobart; Bothwell.

vicissata, Gn. P.L.S.N.S.W. 1890, p. 872. Hobart; Mt. Wellington, 2,500 ft.; Bothwell; Ross; Launceston; Moina, 2,000 ft.

**Acalyphes*, Turn.

**philorites*, Turn. P.R.S. Tas. 1925. Cradle Mt., 3,000 ft.

Dasysternica, Turn.

**pericalles*, Turn. Tr. R.S.S.A. 1922, p. 256. Bothwell; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.

**bertha*, Swin. P.R.S. Tas. 1925. Mt. Wellington, 3,500-4,000 ft.; Lake Fenton, 3,500 ft.; Cradle Mt.. 3,000 ft.

Dasyuris, Gn.

euclidiata, Gn. P.L.S.N.S.W. 1890, p. 876. Hobart; Bothwell; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.

polycarpa, Meyr. P.L.S.N.S.W. 1890, p. 841. Cradle Mt., 3,000 ft.

decisaria, Wlk. P.L.S.N.S.W. 1890, p. 875. Mt. Wellington; Launceston.

hedylepta, Turn. P.R.S. Vic. 1903, p. 279. Moina, 2,000 ft.; Cradle Mt., 3,000 ft.

Notoreas, Meyr.

**æthalopa*, Turn. P.L.S.N.S.W. 1906, p. 710. Zeehan.

STERRHIDÆ.

Eois, Hb.

albicostata, Wlk. P.L.S.N.S.W. 1906, p. 645 (*costaria*). Hobart; Burnie.

costaria, Wlk. P.L.S.N.S.W. 1887, p. 844 (*albicostata*). Hobart; Launceston; Deloraine.

halmæa, Meyr. P.L.S.N.S.W. 1887, p. 846. Russell Falls; Lake Fenton, 3,500 ft.; St. Helens; Launceston; Wilmot; Burnie; Strahan.

philocosma, Meyr. P.L.S.N.S.W. 1887, p. 845. Hobart; Russell Falls; Bothwell; St. Helens; Launceston; Beaconsfield; Rosebery; Strahan.

Scopula, Schrank.

perlata, Wlk. P.L.S.N.S.W. 1887, p. 860. Mt. Wellington, 2,500 ft.; Russell Falls; Bothwell; Wilmot; Burnie; Rosebery; Zeehan.

liotis, Meyr. P.L.S.N.S.W. 1887, p. 854. Hobart; Great Lake, 3,000 ft.; Moina, 2,000 ft.

rubraria, Dbld. P.L.S.N.S.W. 1887, p. 852. Hobart; St. Helens; Launceston; Sheffield.

optivata, Wlk. P.L.S.N.S.W. 1887, p. 857. Hobart; Deloraine.

Dasybela, Turn.

achroa, Low. P.L.S.N.S.W. 1907, p. 667. Hobart.

GEOMETRIDÆ.

Julops, Prout.

argocrana, Meyr. P.L.S.N.S.W. 1887, p. 867. Strahan.

Euloxia, Warr.

gratiosata, Gn. P.L.S.N.S.W. 1887, p. 886. Hobart; Great Lake, 3,000 ft.; Launceston; George Town; Cradle Mt., 3,000 ft.; Strahan.

meandraria, Gn. P.L.S.N.S.W. 1887, p. 874. Hobart; Beaconsfield; Rosebery; Zeehan.

fugitivaria, Gn. P.L.S.N.S.W. 1887, p. 876. Launceston; Deloraine.

**leucochorda*, Meyr. P.L.S.N.S.W. 1887, p. 875. Lottah; Launceston; Deloraine; Cradle Mt., 3,000 ft.

Chlorocoma, Turn.

cadmaria, Gn. P.L.S.N.S.W. 1887, p. 886. Hobart; Beaconsfield; George Town; Rosebery; Zeehan; Strahan.

**rhodothrix*, Turn. Tr. R.S.S.A. 1922, p. 273. Cradle Mt., 3,000 ft.; Strahan.

dichloraria, Gn. P.L.S.N.S.W. 1887, p. 884. Hobart; Brighton; St. Helens; Launceston; Beaconsfield; Burnie; Zeehan.

carenaria, Gn. P.L.S.N.S.W. 1910, p. 584. Hobart.

assimilis, Luc. P.L.S.N.S.W. 1910, p. 581. Hobart.

externa, Wlk. P.L.S.N.S.W. 1887, p. 888. Hobart; Deloraine.

melocrossa, Meyr. P.L.S.N.S.W. 1887, p. 879. Hobart; Tasman Peninsula; Deloraine; Rosebery; Strahan.

tetraspila, Low. Tr. R.S.S.A. 1901, p. 66. Beaconsfield.

Gelasma, Warr.

semicrocea, Wlk. P.L.S.N.S.W. 1887, p. 887. Hobart; Mt. Wellington, 2,500 ft.; Lake Fenton, 3,500 ft.; Beaconsfield.

calaïna, Turn. P.L.S.N.S.W. 1910, p. 600. Rosebery.

centrophylla, Meyr. P.L.S.N.S.W. 1887, p. 880. Mt. Wellington, 2,500 ft.; St. Helens; Beaconsfield; George Town.

Eucyclodes, Warr.

insperata, Wlk. P.L.S.N.S.W. 1887, p. 895. St. Helens.

buprestaria, Gn. P.L.S.N.S.W. 1887, p. 890. Cygnet; Launceston.

Apodasmia, Turn.

rufonigraria, Wlk. P.L.S.N.S.W. 1887, p. 916.

Chlorodes, Gn.

boisduvalaria, Le Guil. P.L.S.N.S.W. 1887, p. 892. Hobart; Launceston; Beaconsfield; Rosebery.

Cyneoterpna, Prout.

wilsoni, Feld. P.L.S.N.S.W. 1887, p. 906. Russell Falls.

Crypsiphona, Meyr.

occultaria, Don. P.L.S.N.S.W. 1887, p. 903. Hobart; Tasman Peninsula; Cygnet; Launceston; Wilmot.

Heliomystis, Meyr.

electrica, Meyr. P.L.S.N.S.W. 1887, p. 900. St. Mary's.

BOARMIADÆ.

Diastictis, Hb.

australiaria, Gn. P.L.S.N.S.W. 1891, p. 587. Hobart; Swansea; Launceston; Deloraine.

Melanodes, Gn.

anthracitaria, Gn. P.L.S.N.S.W. 1891, p. 622. Hobart; Zeehan.

Ectropis, Hb.

fractaria, Gn. P.L.S.N.S.W. 1891, p. 629. Hobart; St. Helens; Launceston; Sheffield.

subtinctaria, Wlk. P.L.S.N.S.W. 1891, p. 628. Launceston; Ulverstone.

excursaria, Gn. P.L.S.N.S.W. 1891, p. 609. Hobart; St. Helens; Launceston; Ulverstone; Strahan.

despicata, Wlk. P.L.S.N.S.W. 1891, p. 612. Hobart; Mt. Wellington; Launceston; Sheffield; Wilmot; Rosebery.

exsuperata, Wlk. P.L.S.N.S.W. 1891, p. 628. Beaconsfield; Ulverstone.

Boarmia, Treit.

lyciaria, Gn. P.L.S.N.S.W. 1891, p. 604. Hobart; Bothwell; Ross; Launceston; Zeehan.

**epiphlœa*, Turn. P.R.S. Tas. 1925. Moina, 2,000 ft.; Zeehan; Strahan.

cognata, Wlk. P.L.S.N.S.W. 1891, p. 606. Hobart; Launceston; Deloraine.

destinataria, Gn. P.L.S.N.S.W. 1891, p. 613..

**epiconia*, Turn. P.R.S. Tas. 1925. Mt. Wellington, 3,000 ft.

**proschora*, Turn. P.R.S. Tas. 1925. Zeehan.

**atycta*, Turn. P.R.S. Tas. 1925. Lake Fenton, 3,500 ft.

Syneora, Turn.

mundifera, Wlk. P.L.S.N.S.W. 1891, p. 598 (*silicaria*). Launceston; Strahan.

**symphonica*, Turn. P.R.S. Tas. 1925. Hobart; Beaconsfield; Moina, 2,000 ft.; Rosebery.

strixata, Wlk. P.L.S.N.S.W. 1891, p. 598 (*cheleuta*). Beaconsfield.

Psilosticha, Meyr.

mactaria, Gn. P.L.S.N.S.W. 1891, p. 624. Hobart; St. Helens.

Osteodes, Gn.

procurata, Wlk. P.L.S.N.S.W. 1891, p. 589. Hobart.

Cleora, Curtis.

bitæniaria, Le Guil. P.L.S.N.S.W. 1891, p. 616. Hobart; Campbell Town; Launceston.

**nesiotis*, Turn. P.R.S. Tas. 1925. Rosebery.

Lyelliana, Turn.

**pristina*, Turn. P.R.S. Tas. 1925. Cradle Mt., 3,000 ft.

Metrocampa, Latr.

biplaga, Wlk. P.L.S.N.S.W. 1891, p. 644 (*glaucias*). Russell Falls; Beaconsfield; Ulverstone; Strahan.

ada, Butl. P.L.S.N.S.W. 1891, p. 645. Hobart; Launceston.

Lomographa, Hb.

**odontocrossa*, Turn. Tr. R.S.S.A. 1906, p. 134. Strahan.

icasta, Turn. P.L.S.N.S.W. 1919, p. 261. Hobart; Rosebery; Strahan.

Casbia, Wlk.

**œnias*, Meyr. P.L.S.N.S.W. 1891, p. 637. St. Helens.

alphitopis, Turn. P.L.S.N.S.W. 1919, p. 269. Mt. Wellington, 2,500 ft.; Strahan.

eccentritis, Meyr. P.L.S.N.S.W. 1891, p. 635. Mt. Wellington, 2,500 ft.; Russell Falls; Launceston; Burnie; Strahan.

sciagrapha, Turn. P.L.S.N.S.W. 1919, p. 271. Great Lake, 3,000 ft.

Rhinodia, Gn.

rostraria, Gn. P.L.S.N.S.W. 1891, p. 640. Hobart.

Idiodes, Gn.

apicata, Gn. P.L.S.N.S.W. 1891, p. 643. Hobart; Tasman Peninsula; Lake Fenton, 3,500 ft.; St. Helens; Ulverstone; Burnie.

Planolocha, Meyr.

obliquata, Luc. P.R.S.Q. 1892, p. 80. Rosebery.

Neritodes, Gn.

verrucata, Gn. P.L.S.N.S.W. 1891, p. 652. Hobart; Bothwell; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.; Rosebery; Zeehan; Strahan.

Amelora, Meyr.

sparsularia, Gn. P.L.S.N.S.W. 1891, p. 648. Rosebery.

crenulata, Turn. P.R.S. Tas. 1925. Mt. Wellington, 2,500 ft.; Russell Falls; Cradle Mt., 3,000 ft.

**suffusa*, Turn. P.R.S. Tas. 1925. Mt. Wellington; Lake Fenton, 3,500ft.; Cradle Mt., 3,000ft.

**cyclocentra*, Turn. P.R.S. Tas. 1925. Rosebery; Strahan.
australis, Rosen. P.L.S.N.S.W., 1891, p. 649. Hobart.
catacris, Meyr. P.L.S.N.S.W. 1891, p. 650. Strahan.
milvaria, Gn. P.L.S.N.S.W. 1891, p. 650. Launceston.
arotræa, Meyr. P.L.S.N.S.W. 1891, p. 651. Hobart.
leucaniata, Gn. P.L.S.N.S.W. 1891, p. 651. Rosebery; Zeehan.
oritropha, Turn. P.L.S.N.S.W. 1919, p. 308. Cradle Mt., 3,000 ft.
**oxytona*, Turn. P.R.S. Tas. 1925. Rosebery.

Encryphodes, Turn.
**melanochorda*, Turn. P.L.S.N.S.W. 1919, p. 384. Hobart.

Thalaina, Wlk.
selenæa, Dbld. P.L.S.N.S.W. 1891, p. 653. Hobart; Launceston; Rosebery; Zeehan.
inscripta, Wlk. P.L.S.N.S.W. 1891, p. 655. Mt. Wellington, 1,500 ft.; Bothwell; Launceston; Moina, 2,000 ft.

Mnesampela, Meyr.
comarcha, Meyr. P.L.S.N.S.W. 1891, p. 656. Launceston.
privata, Gn. P.L.S.N.S.W. 1891, p. 658. Bothwell; Launceston; Wilmot; Cradle Mt., 3,000 ft.
fucata, Feld. P.L.S.N.S.W. 1891, p. 658. Zeehan.

Fisera, Wlk.
perplexata, Wlk. P.L.S.N.S.W. 1891, p. 659 (*belidearia*).

Stathmorrhopa, Meyr.
beggaria, Gn. P.L.S.N.S.W. 1891, p. 660. Hobart; Mt. Wellington; Bothwell; Launceston.

Smyriodes, Gn.
aplectaria, Gn. P.L.S.N.S.W. 1891, p. 667. Launceston.
carburaria, Gn. Tr. R.S.S.A. 1893, p. 164. Launceston.

Gastrina, Gn.
cristaria, Gn. P.L.S.N.S.W. 1891, p. 668. Launceston.

Mictodoca, Meyr.
toxeuta, Meyr. P.L.S.N.S.W. 1891, p. 661. Beaconsfield.

Conosara, Meyr.

**castaneata*, Meyr. P.L.S.N.S.W. 1891, p. 660. Hobart; Launceston.

Capusa, Wlk.

senilis, Wlk. Cat. Brit. Mus. XI., p. 621. Launceston.

Ciampa, Wlk.

arietaria, Gn. P.L.S.N.S.W. 1891, p. 663. Hobart; Launceston.

Chlenias, Gn.

umbraticaria, Gn. P.L.S.N.S.W. 1891, p. 664.

banksiaria, Le Guil. P.L.S.N.S.W. 1891, p. 664. Launceston.

zonæa, Meyr. P.L.S.N.S.W. 1891, p. 665. Hobart; Launceston.

seminigra, Rosen. P.L.S.N.S.W. 1891, p. 666. Hobart.

psolina, Turn. P.L.S.N.S.W. 1919, p. 401. Sheffield.

Stibaroma, Meyr.

melanotoxa, Meyr. P.L.S.N.S.W. 1891, p. 669.

**Ecpatites*, Turn.

**callipolia*, Turn. P.R.S. Tas. 1925. Rosebery.

Drymoptila, Meyr.

temenitis, Meyr. P.L.S.N.S.W. 1891, p. 670. Hobart; Mt. Wellington, 2,500 ft.

**Archephanes*, Turn.

**zalosema*, Turn. P.R.S. Tas. 1925. Mt. Wellington, 4,000 ft.; Lake Fenton, 3,500 ft.; Cradle Mt., 3,000 ft.

**Hypsitropha*, Turn.

**euschema*, Turn. P.R.S. Tas. 1925. Mt. Wellington, 2,500 ft.; Lake Fenton, 3,500 ft.; Cradle Mt., 3,000 ft.

**Neoteristis*, Meyr.

**paraphanes*, Meyr. P.L.S.N.S.W. 1891, p. 672. Deloraine.

**Dirce*, Prout.

**æsiodora*, Turn. Tr. R.S.S.A. 1922, p. 291. Cradle Mt., 3,000 ft.

**solaris*, Meyr. P.L.S.N.S.W. 1889, p. 1195. Mt. Wellington, 4,000 ft.

**lunaris*, Meyr. P.L.S.N.S.W. 1889, p. 1195. Mt. Wellington, 4,000 ft.

**oriplancta*, Turn. P.R.S. Tas. 1925. Lake Fenton, 3,500 ft.

ŒNOCHROMIDÆ.

Adeixis, Warr.

inostentata, Wlk. Cat. Brit. Mus. XXIII., p. 1012. Hobart; Zeehan; Strahan.

Dichromodes, Gn.

ainaria, Gn. P.L.S.N.S.W. 1889, p. 1170. Hobart; St. Helens; Zeehan; Strahan.

**diasemaria*, Gn. P.R.S. Tas. 1925. St. Helens; Cradle Mt., 3,000 ft.; Strahan.

euscia, Meyr. P.L.S.N.S.W. 1889, p. 1185. Zeehan; Strahan.

**trychnoptila*, Turn. Tr. R.S.S.A. 1906, p. 131. Zeehan.

consignata, Wlk. P.L.S.N.S.W. 1889, p. 1191. St. Helens.

stilbiata, Gn. P.L.S.N.S.W. 1889, p. 1192. Hobart; Lake Fenton, 3,500 ft.; Deloraine; Cradle Mt., 3,000 ft.; Rosebery; Zeehan; Strahan.

confluaria, Gn. P.L.S.N.S.W. 1889, p. 1193. Hobart; St. Helens; Launceston; Deloraine; Zeehan.

**phæostropha*, Turn. P.R.S. Tas. 1925. Beaconsfield; Rosebery; Strahan.

Ncarcha, Meyr.

buffalaria, Gn. P.L.S.N.S.W. 1889, p. 1154.

subcelata, Wlk. P.L.S.N.S.W. 1889, p. 1157. Hobart.

curtaria, Gn. P.L.S.N.S.W. 1889, p. 1158. Hobart; Russell Falls; George Town; Beaconsfield; Ulverstone; Strahan.

Antasia, Warr.

flavicapitata, Gn. P.L.S.N.S.W. 1889, p. 1152. Hobart; St. Helens; Launceston; Strahan.

Zeuctophlebia, Warr.

squalidata, Wlk. Cat. Brit. Mus. XXVI., p. 1671. Launceston.

Taxeotis, Meyr.

inconcisata, Wlk. P.L.S.N.S.W. 1889, p. 1146 (*delogramma*). St. Helens; Deloraine; Prospect.

oraula, Meyr. P.L.S.N.S.W. 1889, p. 1143. Russell Falls; Beaconsfield; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.; Burnie; Rosebery; Strahan.

subvelaria, Wlk. P.L.S.N.S.W. 1889, p. 1150 (*isophanes*). Hobart; Prospect.

anthracopa, Meyr. P.L.S.N.S.W. 1889, p. 1145. Hobart; Deloraine.

Epidesmia, Westw.

hypenaria, Gn. P.L.S.N.S.W. 1889, p. 1163. Hobart; Mt. Wellington, 2,500 ft.; Russell Falls; Lake Fenton, 3,500 ft.; St. Helens; Launceston; Deloraine; Cradle Mt., 3,000 ft.

Monoctenia, Gn.

falernaria, Gn. P.L.S.N.S.W. 1889, p. 1208. Hobart.

Arhodia, Gn.

lasiocamparia, Gn. P.L.S.N.S.W. 1889, p. 1202. Hobart.

Hypographa, Gn.

phlegetonaria, Gn. P.L.S.N.S.W. 1889, p. 1212.

Onycodes, Gn.

traumataria, Gn. P.L.S.N.S.W. 1889, p. 1200. Hobart; Beaconsfield; Ulverstone; Rosebery; Strahan.

Circopetes, Prout.

obtusata, Wlk. P.L.S.N.S.W. 1889, p. 1207.

Oenochroma, Gn.

vetustaria, Wlk. P.L.S.N.S.W. 1889, p. 1207 (*diggle-saria*). Bothwell.

NOTODONTIDÆ.

Cnethocampinæ.

Trichetra, Westw.

sparshalli, Curtis. P.L.S.N.S.W. 1922, p. 363. Hobart; Launceston.

Epicoma, Hb.

melanospila, Wlgrn. P.L.S.N.S.W. 1922, p. 365. Hobart; Launceston.

melanosticta, Don. P.L.S.N.S.W. 1922, p. 367. Hobart; Launceston.

tristis, Lewin. P.L.S.N.S.W. 1922, p. 367. Hobart; Beaconsfield.

Teara, Wlk.

**periblepta*, Turn. P.L.S.N.S.W. 1922, p. 372. Mt. Wellington; Lake Fenton, 3,500 ft.; Cradle Mt., 3,000 ft.

Oenosanda, Wlk.
boisduvalii, Newm. P.L.S.N.S.W. 1903, p. 58. Hobart; Launceston.

Notodontinæ.

Hyleora, Dbld.
inclyta, Wlk. P.L.S.N.S.W. 1903, p. 47.

Neola, Wlk.
semiaurata, Wlk. P.L.S.N.S.W. 1903, p. 49.

Sorama, Wlk.
bicolor, Wlk. P.L.S.N.S.W. 1903, p. 51. Launceston; Ulverstone.

Gallaba, Wlk.
eugraphes, Turn. P.L.S.N.S.W. 1922, p. 388. Lake Fenton, 3,500 ft.; Cradle Mt., 3,000 ft.; Zeehan; Strahan.

SPHINGIDÆ.

Hippotion, Hb.
celerio, Lin. Hobart; Launceston.
scrofa, Bdv. Hobart; Launceston.

NOCTUOIDEA.

ARCTIADÆ.

Hestiarcha, Meyr.
**atala*, Turn. P.R.S. Vic. 1922, p. 29. Mt. Wellington.

**Thermeola*, Hmps.
**tasmanica*, Hmps. Cat. Lep. Phal. II., p. 96. Hobart.

Scoliacma, Meyr.
bicolor, Bdv. Cat. Lep. Phal. II., p. 103. Tasman Peninsula; Launceston.

Phæophlebosia, Hmps.
furcifera, Wlk. P.L.S.N.S.W. 1886, p. 698. Hobart; Bothwell.

Apistosia, Hb.
chionora, Meyr. P.L.S.N.S.W. 1886, p. 702. Launceston.

Palæosia, Hmps.
bicosta, Wlk. P.L.S.N.S.W. 1886, p. 702. Hobart; Bothwell; Launceston; Beaconsfield; Wilmot; Rosebery.

Halone, Wlk.

sejuncta, Feld. P.L.S.N.S.W. 1886, p. 730. Launceston; Beaconsfield.

Caprimima, Hmps.

procrena, Meyr. P.L.S.N.S.W. 1886, p. 733. Russell Falls; Lake Fenton, 3,500 ft.; Deloraine; Wilmot; Moina, 2,000 ft.; Rosebery; Zeehan; Strahan.

**sicciodes*, Hmps. P.R.S. Tas. 1925. Mt. Wellington, 2,500 ft.; Russell Falls; Launceston; Moina, 2,000 ft.; Zeehan; Strahan.

Asura, Wlk.

lydia, Don. P.L.S.N.S.W. 1886, p. 747. Launceston.

cervicalis, Wlk. P.L.S.N.S.W. 1886, p. 748. Ross; Swansea; Launceston; Beaconsfield; George Town.

**habrotis*, Meyr. P.L.S.N.S.W. 1886, p. 748.

Thallarcha, Meyr.

albicollis, Feld. P.L.S.N.S.W. 1886, p. 737. Hobart; Triabunna; Bothwell.

**isophragma*, Meyr. P.L.S.N.S.W. 1886, p. 296. Bothwell; St. Helens; Launceston.

**epiostola*, Turn. P.R.S. Tas. 1925. Launceston.

jocularis, Rosen. P.L.S.N.S.W. 1886, p. 741. Moina, 2,000 ft.; Cradle Mt., 3,000 ft.

**Nesotropha*, Turn.

**pygmæodes*, Turn. P.R.S. Tas. 1925. Cradle Mt., 3,000 ft.

Philenora, Rosen.

undulosa, Wlk. Tr. R.S.S.A. 1892, p. 149 (*lyelliana*).

Castulo, Wlk.

plagiata, Wlk. P.L.S.N.S.W. 1886, p. 715 (*struthias*). Dunalley.

doubledayi, Newm. P.L.S.N.S.W. 1886, p. 716 (*rubricosta*). Hobart; Launceston.

Ardices, Wlk.

curvata, Don. P.L.S.N.S.W. 1886, p. 752 (*fuscinula*). Geeveston; George Town.

**vigens*, Butl. P. Zool. Soc. 1878, p. 383. George Town.

glatignyi, Le Guil. P.L.S.N.S.W. 1886, p. 754 (*fulvohirta*). Hobart; Tasman Peninsula.

Diacrisia, Hb.

canescens, Butl. P.L.S.N.S.W. 1886, p. 755 (*obliqua*). Launceston; Latrobe.

Amsacta, Wlk.

marginata, Don. P.L.S.N.S.W. 1886, p. 755. Beaconsfield.

Phaos, Wlk.

**interfixa*, Wlk. P.R.S. Tas. 1925. Mt. Wellington; Cradle Mt., 3,000 ft.

**acmena*, Turn. P.R.S. Tas. 1925. Bothwell; Launceston.

Utetheisa, Hb.

pulchella, Lin. P.L.S.N.S.W. 1886, p. 758. Launceston; Strahan.

Nolidæ.

Celama, Wlk.

paromœa, Meyr. P.L.S.N.S.W. 1886, p. 721. Wilmot; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.

albalis, Wlk. P.L.S.N.S.W. 1886, p. 721 (*vetustella*). Hobart; St. Helens; Launceston; Zeehan.

biguttalis, Wlk. P.L.S.N.S.W. 1886, p. 719 (*trigonota*). Beaconsfield; Rosebery; Strahan.

**tholera*, Turn. P.R.S. Tas. 1925. Wilmot.

Nola, Leach.

semograpta, Meyr. P.L.S.N.S.W. 1886, p. 720. Bothwell; Deloraine.

parallacta, Meyr. P.L.S.N.S.W. 1886, p. 723. Hobart; Cradle Mt., 3,000 ft.; Strahan.

cycota, Meyr. P.L.S.N.S.W. 1886, p. 723. Zeehan; Strahan.

aulacota, Meyr. P.L.S.N.S.W. 1886, p. 722. Mt. Wellington; Launceston; Deloraine; Strahan.

**macrorrhyncha*, Turn. P.R.S. Tas. 1925. Hobart.

Rœselia, Hb.

lugens, Wlk. Cat. Lep. Phal. II., p. 72. Hobart; Bothwell; Launceston; Beaconsfield.

Noctuidæ.

Agaristinæ.

Eutrichopidia, Hmps.

latina, Don. Cat. Lep. Phal. III., p. 554. Hobart; Launceston.

Phalænoides, Lewin.

glycinæ, Lewin. Cat. Lep. Phal. III., p. 558. Launceston.

tristifica, Hb. Cat. Lep. Phal. III., p. 559. Mt. Wellington; Dunalley; Russell Falls; Lymington; Launceston; Deloraine; Cradle Mt.; Burnie.

Hecatesia, Bdv.

fenestrata, Bdv. Cat. Lep. Phal. III., p. 594. Cygnet; Tasman Peninsula; Beaconsfield; Strahan.

Radinocera, Hmps.

**placodes*, Low. Tr. R.S.S.A. 1903, p. 30. Hobart.

Agaristodes, Hmps.

feisthameli, H-Sch. Cat. Lep. Phal. IX., p. 456.

Apina, Wlk.

callista, Wlk. Cat. Lep. Phal. IX., p. 449. Hobart.

Agrotinæ.

Heliothis, Ochs.

obsoleta, Fab. Cat. Lep. Phal. IV., p. 657. Launceston; Wynyard.

Euxoa, Hb.

radians, Gn. Cat. Lep. Phal. IV., p. 164. Hobart; Launceston.

porphyricollis, Gn. Cat. Lep. Phal. IV., p. 165. Hobart; Cygnet; Ross; Launceston.

repanda, Wlk. Cat. Lep. Phal. IV., p. 163. Launceston.

Agrotis, Ochs.

infusa, Bdv. Cat. Lep. Phal. IV., p. 164. Hobart; Geeveston; Launceston.

Graphiphora, Ochs.

compta, Wlk. Cat. Lep. Phal. IV., p. 409. Hobart; Launceston.

Proteuxoa, Hmps.

amaurodes, Low. P.L.S.N.S.W. 1901, p. 642. Beaconsfield.

Melanchrinæ.

Sideridis, Hb.

**eboriosa*, Gn. Cat. Lep. Phal. V., p. 479. Hobart; Launceston.

**costalis*, Wlk. Cat. Lep. Phal. V., p. 479.

obusta, Gn. Cat. Lep. Phal. V., p. 479.

exarans, Luc. Tr. R.S.S.A. 1908, p. 56 (*orthomita*). Cradle Mt.

unipuncta, Haw. Cat. Lep. Phal. V., p. 547. Launceston.

ewingii, Westw. Cat. Lep. Phal. V., p. 386. Hobart; Launceston.

Dasygaster, Gn.

ligniplena, Wlk. Cat. Lep. Phal. V., p. 474. Hobart; Mt. Wellington; Wilmot; Strahan.

nephelistis, Hmps. Cat. Lep. Phal. V., p. 475.

hollandiæ, Gn. Cat. Lep. Phal. V., p. 476. Hobart; Bothwell; Launceston; Cradle Mt., 3,000 ft.; Zeehan.

**epundoides*, Gn. Cat. Lep. Phal. V., p. 477. Hobart; Mt. Wellington; Cradle Mt.

**pammacha*, Turn. P.R.S. Vic. 1923, p. 33. Lake Fenton, 3,500 ft.; Cradle Mt., 3,000 ft.

Cucullianæ.

Neumichtis, Hmps.

trijuncta, Wlk. Cat. Lep. Phal. VI., p. 298. Launceston.

Eumichtis, Hb.

sepultrix, Gn. Cat. Lep. Phal. VI., p. 333. Hobart; Mt. Wellington; Brighton; St. Mary's; Launceston; Cradle Mt.; Strahan.

saliaris, Gn. Cat. Lep. Phal. VI., p. 342. Hobart; Mt. Wellington, 2,500 ft.; Brighton; Bothwell; Wilmot; Burnie; Strahan.

Acronyctinæ.

Cosmodes, Gn.

elegans, Don. Cat. Lep. Phal. VIII., p. 17. Launceston.

Euplexia, Stph.

**iorrhoa*, Meyr. Tr. Ent. Soc. 1902, p. 27. Hobart; Mt. Wellington; Lake Fenton, 3,500 ft.; Cradle Mt., 3,000 ft.

bryochlora, Meyr. Tr. Ent. Soc. 1897, p. 371.

**signata*, Low. Tr. R.S.S.A. 1905, p. 173. Hobart; Launceston.

**calliphara*, Turn. P.R.S. Tas. 1925. Bothwell; Moina, 2,000 ft.

nigerrima, Gn. Noct. I., p. 200. Hobart; Launceston.

Bathytricha, Turn.

truncata, Wlk. Cat. Lep. Phal. IX., p. 267.

Peripyra, Hmps.

sanguinipuncta, Gn. Cat. Lep. Phal. VII., p. 25. Hobart; Bothwell; Launceston; Rosebery.

Prometopus, Gn.

inassueta, Gn. P.L.S.N.S.W. 1902, p. 86 (*chromoneura*). Hobart; Launceston; Ulverstone.

Omphaletis, Hmps.

melodora, Low. Cat. Lep. Phal. VIII., p. 379. Launceston.

Caradrina, Ochs.

exundans, Gn. Cat. Lep. Phal. VIII., p. 377. Hobart; Tasman Peninsula.

tortisigna, Wlk. Cat. Lep. Phal. VIII., p. 390. Hobart.

paratorna, Low. P.L.S.N.S.W. 1902, p. 655. Launceston; Beaconsfield; Ulverstone.

hydræcioides, Gn. P.L.S.N.S.W. VIII., p. 395.

marginalis, Wlk. Cat. Lep. Phal. VIII., p. 396. Hobart.

bistrigula, Wlk. Cat. Lep. Phal. VIII., p. 399. Hobart.

capularis, Gn. Cat. Lep. Phal. VIII., p. 400. Hobart; Beaconsfield.

atra, Gn. Cat. Lep. Phal. VIII., p. 401. Hobart; Launceston.

atrisquamata, Low. P.L.S.N.S.W. 1902, p. 653. Hobart.

interferens, Wlk. Cat. Lep. Phal. VIII., p. 406. Hobart.

flexirena, Wlk. Cat. Lep. Phal. VIII., p. 406. Hobart.

Plusianæ.

Plusia, Ochs.

argentifera, Gn. Cat. Lep. Phal. XIII., p. 489. Hobart; Launceston; Ulverstone.

Noctuinæ.

Corrha, Wlk.

**difficilis*, Wlk. Cat. Brit. Mus. XIII., p. 1090.

Praxis, Gn.

edwardsi, Gn. Noct. III., p. 29. Launceston; Ulverstone.

porphyretica, Gn. Noct. III., p. 29.

Diatenes, Gn.
gerula, Gn. Noct. II., p. 443.

Dasypodia, Gn.
selenophora, Gn. Noct. III., p. 175. Launceston.

Alapadna, Turn.
pauropis, Turn. P.L.S.N.S.W. 1902, p. 106. Russell Falls; Launceston; Burnie.

Rhapsa, Wlk.
suscitalis, Wlk. Cat. Brit. Mus. XVI., p. 83. Russell Falls.

Artigisa, Wlk.
**lignicolaria*, Wlk. Cat. Brit. Mus. XXXV., p. 1579. Hobart; Russell Falls; Bothwell; Launceston; Wilmot; Ulverstone.
**melanephele*, Hmps. *ined?*

Sandava, Wlk.
xylistis, Swin. Tr. E.S. 1902, p. 37. Launceston.

Rhodina, Gn.
falculalis, Gn. Tr. R.S.S.A. 1897, p. 52 (*mesochra*). Russell Falls; Rosebery; Zeehan; Strahan.

Liodes, Gn.
neurogramma, Turn. Tr. R.S.S.A. 1906, p. 123. George Town.

Meyrickiella, Berg.
ruptella, Wlk. Cat. Brit. Mus. XXVII., p. 173. Hobart; Beaconsfield.

Hypeninæ.

Tipasa, Wlk.
asthenopa, Meyr. Tr. Ent. Soc. 1902, p. 40. Launceston; Burnie; Strahan.

LYMANTRIADÆ.

Porthesia, Stph.
melanosoma, Butl. P.L.S.N.S.W. 1920, p. 478. Hobart; Mt. Wellington; Launceston; George Town.

Acyphas, Wlk.
leucomelas, Wlk. P.L.S.N.S.W. 1920, p. 481. Hobart; Bothwell; Swansea; Launceston; Beaconsfield; George Town; Latrobe.
**fulviceps*, Wlk. P.L.S.N.S.W. 1920, p. 482. Hobart.

Euproctis, Hb.

marginalis, Wlk. P.L.S.N.S.W. 1920, p. 487.

Orgyia, Ochs.

anartoides, Wlk. P.L.S.N.S.W. 1920, p. 493. Hobart; Bothwell; Launceston.

HYPSIDÆ.

Nyctemera, Hb.

amica, White. P.L.S.N.S.W. 1886, p. 760. Hobart; Triabunna; Launceston; Beaconsfield.

ANTHELIDÆ.

Pterolocera, Wlk.

amplicornis, Wlk. P.L.S.N.S.W. 1921, p. 165. Hobart; Launceston; Cradle Mt., 3,000 ft.; Latrobe; Strahan.

Nataxa, Wlk.

flavescens, Wlk. P.L.S.N.S.W. 1921, p. 166.

Anthela, Wlk.

ferruginosa, Wlk. P.L.S.N.S.W. 1921, p. 171. Hobart; Launceston.

**pyrrhobaphes,* Turn. P.R.S. Tas. 1925. Zeehan.

**phæozona,* Turn. P.R.S. Tas. 1925. Bothwell.

acuta, Wlk. P.L.S.N.S.W. 1921, p. 176. Hobart; Swansea; Launceston; Sheffield; Ulverstone; Burnie.

**cnecias,* Turn. P.L.S.N.S.W. 1921, p. 178. Launceston.

ocellata, Wlk. P.L.S.N.S.W. 1921, p. 178. Hobart; Launceston.

addita, Wlk. P.L.S.N.S.W. 1921, p. 183. Hobart; Ulverstone.

repleta, Wlk. P.L.S.N.S.W. 1921, p. 185. Bothwell; Launceston; Sheffield.

connexa, Wlk. P.L.S.N.S.W. 1921, p. 186. Launceston; Strahan.

nicothoë, Bdv. P.L.S.N.S.W. 1921, p. 186. Hobart; Launceston.

LASIOCAMPOIDEA.

LASIOCAMPIDÆ.

Pinara, Wlk.

cana, Wlk. P.L.S.N.S.W. 1924, p. 404. Launceston.

obliqua, Wlk. P.L.S.N.S.W. 1924, p. 404. Launceston.

Crexa, Wlk.

punctigera, Wlk. P.L.S.N.S.W. 1924, p. 406. Hobart; Geeveston; Launceston; Ulverstone.

vetusta, Wlk. P.L.S.N.S.W. 1924, p. 411. Launceston.

Porela, Wlk.

**subfasciata*, Wlk. P.L.S.N.S.W. 1924, p. 413. Beaconsfield; George Town; Ulverstone.

albifinis, Wlk. P.L.S.N.S.W. 1924, p. 415. Hobart; Launceston.

**contermina*, Wlk. P.L.S.N.S.W. 1924, p. 415.

Entometa, Wlk.

marginata, Wlk. P.L.S.N.S.W. 1924, p. 418.

fervens, Wlk. P.L.S.N.S.W. 1924, p. 418. Launceston.

apicalis, Wlk. P.L.S.N.S.W. 1924, p. 419. Launceston.

Diggleşia, Turn.

rufescens, Wlk. P.L.S.N.S.W. 1924, p. 423. Hobart; Mt. Wellington, 2,500 ft.

**nana*, Wlk. P.L.S.N.S.W. 1924, p. 424. Launceston.

australasiæ, Fab. P.L.S.N.S.W. 1924, p. 424. Hobart; Bothwell; Launceston; Ulverstone; Strahan.

Opsirhina, Wlk.

albigutta, Wlk. P.L.S.N.S.W. 1924, p. 425. Hobart; Launceston.

Perna, Wlk.

exposita, Lewin. P.L.S.N.S.W. 1924, p. 427. Hobart.

PSYCHOIDEA.

Limacodidæ.

Doratifera, Westw.

pinguis, Wlk. Cat. Brit. Mus. V., p. 1119. Hobart; Triabunna; Launceston.

Zygænidæ.

Hestiochora, Meyr.

tricolor, Wlk. P.L.S.N.S.W. 1886, p. 789. Hobart; Triabunna; Launceston; Deloraine.

Pollanisus, Wlk.

cyanotus, Meyr. P.L.S.N.S.W. 1886, p. 793. Hobart; Rosebery; Strahan.

subdolosus, Wlk. P.L.S.N.S.W. 1886, p. 793. Launceston; Beaconsfield.
viridipulverulentus, Guer. P.L.S.N.S.W. 1886, p. 794. Hobart; Tasman Peninsula; Launceston; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.; Zeehan; Strahan.
calliceros, Turn. P.R.S. Tas. 1925. Moina, 2,000 ft.

Procris, Fab.
dolens, Wlk. P.L.S.N.S.W. 1886, p. 791. Hobart; Huon River; Campbell Town; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.; Zeehan.

PSYCHIDÆ.

Clania, Wlk.
dewitzi, Heyl. Tr. R.S.S.A. 1907, p. 196. Launceston.
ignobilis, Wlk. Prod. Zool. Vict., Pl. 40, f. 7-10. Triabunna.
tenuis, Rosen. Tr. R.S.S.A. 1907, p. 197. Launceston.

PYRALOIDEA.

PHYCITIDÆ.

Homœosoma, Curtis.
fornacella, Meyr. P.L.S.N.S.W. 1880, p. 219. St. Helens.
farinaria, Turn. P.R.S.Q. 1903, p. 126. Strahan.

Unadilla, Hulst.
distichella, Meyr. P.L.S.N.S.W. 1878, p. 215. Hobart; Launceston.

Hyphantidium, Scott.
sericarium, Scott. P.L.S.N.S.W. 1880, p. 231 (*microdoxa*). Launceston.

Epicrocis, Zel.
sublignalis, Wlk. P.L.S.N.S.W. 1878, p. 202 (*strigiferella*). Hobart.

Sclerobia, Rag.
tritalis, Wlk. P.L.S.N.S.W. 1878, p. 207 (*vulgatella*). Hobart; Swansea; Bothwell; Beaconsfield.
Etiella, Zel.
behrii, Zel. P.L.S.N.S.W. 1878, p. 205. Strahan.

GALLERIADÆ.

Meyrickia, Rag.
latro, Zel. P.L.S.N.S.W. 1879, p. 238. Freycinet Peninsula.

Heteromicta, Meyr.
pachytera, Meyr. P.L.S.N.S.W. 1879, p. 237. Hobart.

CRAMBIDÆ.

Ptochostŏla, Meyr.
microphæella, Wlk. P.L.S.N.S.W. 1878, p. 190 (*dimidiellus*). Hobart; Tunbridge; Launceston; Beaconsfield.

Crambus, Fab.
cuneiferellus, Wlk. P.L.S.N.S.W. 1878, p. 189. Beaconsfield.

**Notocrambus*, Turn.
**holomelas*, Turn. P.R.S. Vic. 1922, p. 45. Cradle Mt., 3,000 ft.

Thinasotia, Hb.
pentadactyla, Zel. Cat. Brit. Mus. XXXV., p. 1765 (*claviferella*). Hobart; Bothwell; Launceston.

Chilo, Zinck.
lativittalis, Wlk. P.L.S.N.S.W. 1878, p. 183. St. Helens; Deloraine; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.; Rosebery; Strahan.

Sedenia, Gn.
rupalis, Gn. Delt. & Pyr., p. 250. Hobart; Launceston; Latrobe; Strahan.
cervalis, Gn. Delt. & Pyr., p. 250. Hobart; Launceston.

Diptychophora, Zel.
ochracealis, Wlk. P.L.S.N.S.W. 1878, p. 198. Hobart: Mt. Wellington, 2,500 ft.

Talis, Gn.
bivitella, Don. P.L.S.N.S.W. 1878, p. 185 (*trivittatus*). Hobart; Launceston.
pleniferella, Wlk. P.L.S.N.S.W. 1878, p. 187. Hobart; Deloraine.
**impletella*, Wlk. P.L.S.N.S.W. 1879, p. 210. Hobart; Bothwell.
**perlatalis*, Wlk. P.L.S.N.S.W. 1879, p. 213. Hobart; Launceston.
relatalis, Wlk. P.L.S.N.S.W. 1878, p. 191. Hobart; Russell Falls; Launceston; Beaconsfield; Wilmot; Burnie; Rosebery; Zeehan; Strahan.
panselenella, Meyr. P.L.S.N.S.W. 1882, p. 165. Hobart.

opulentella, Zel. P.L.S.N.S.W. 1878, p. 192. Hobart.
orthotypa, Turn. P.R.S.Q. 1903, p. 176. Lake Fenton, 3,500 ft.; Moina, 2,000 ft.; Rosebery; Strahan.
grammella, Zel. P.L.S.N.S.W. 1878, p. 194 (*enneagrammos*). Hobart; Mt. Wellington, 2,500 ft.; Bothwell; Beaconsfield; Wilmot; Moina, 2,000 ft.; Burnie; Strahan.
invalidella, Meyr. P.L.S.N.S.W. 1878, p. 193. Hobart.
acontophora, Meyr. P.L.S.N.S.W. 1882, p. 1671. Hobart; Bothwell.
pedionoma, Meyr. Tr. E.S. 1885, p. 453. Hobart; Launceston.
megalarcha, Meyr. Tr. E.S. 1885, p. 454. Lake Fenton, 3,500 ft.; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.
**gelastis*, Meyr. Tr. E.S. 1887, p. 250. Campbell Town.
enchias, Meyr. Tr. E.S. 1897, p. 380. Hobart.

Schœnobiadæ.

Scirpophaga. Treit.
patulella, Wlk. P.L.S.N.S.W. 1882, p. 161 (*exsanguis*). Hobart; Russell Falls; Launceston; Beaconsfield; George Town; Deloraine; Wilmot; Rosebery; Zeehan; Strahan.

Pyralidæ.

Persicoptera, Meyr.
pulchrinalis, Gn. Delt. & Pyr., p. 220.

Endotricha, Zel.
pyrosalis, Gn. Delt. & Pyr., p. 219. Hobart; Launceston.
docilis, Wlk. Tr. E.S. 1884, p. 79 (*æthopa*). Beaconsfield.

Oenogenes, Meyr.
fugalis, Feld. Tr. E.S. 1884, p. 75. Hobart; Launceston; Deloraine.

Gauna, Wlk.
ægalis, Wlk. Tr. E.S. 1884, p. 74.

Diplopseustis, Meyr.
perieresalis, Wlk. Tr. E.S. 1884, p. 285 (*minima*). Rosebery; Zeehan.

Aglossa, Latr.

pinguinalis, Lin. Brit. Lep., p. 428. Hobart. (*Introduced.*)

Spectatrota, Warr.

fimbrialis, Warr. Ann. Mag. Nat. Hist. (6) VII., p. 427. Hobart.

Catamola, Meyr.

**tholoëssa*, Turn. P.R.S. Tas. 1925. Hobart.

funerea, Wlk. Tr. E.S. 1884, p. 65.

Macalla, Wlk.

recurvalis, Wlk. Tr. E.S. 1887, p. 189. Hobart; Launceston.

**marmorea*, Warr. P.R.S.Q. 1903, p. 198 (*crypserythra*). Hobart; Cygnet; Zeehan.

ebenina, Turn. P.R.S.Q. 1903, p. 197. Ross.

Epipaschia, Clem.

**habitalis*, Gn. Delt. & Pyr., p. 125.

costigeralis, Wlk. Tr. E.S. 1885, p. 439. Hobart; Launceston.

**amauropis*, Turn. P.R.S. Tas. 1925. Strahan.

PYRAUSTIDÆ.

Hydreuretis, Meyr.

oxygramma, Turn. Tr. R.S.S.A. 1908, p. 86. Bothwell.

Nymphula, Schrank.

nitens, Butl. Tr. N.Z. Inst. 1884, p. 122. Hobart; Swansea.

oculalis, Hmps. Tr. E.S. 1897, p. 160. Hobart.

Musotima, Meyr.

ochropteralis, Gn. Delt. & Pyr., p. 230. Launceston.

nitidalis, Wlk. Cat. Brit. Mus. XXXIV., p. 1317. Rosebery; Zeehan; Strahan.

acrias, Meyr. Tr. E.S. 1884, p. 289. Deloraine; Rosebery; Strahan.

stictochroa, Turn. P.R.S.Q. 1915, p. 37. Mt. Wellington, 2,500 ft.; Russell Falls.

Voliba, Wlk.

scoparialis, Wlk. Tr. E.S. 1885, p. 449. Hobart.

Nacoleia, Wlk.

rhœonalis, Wlk. Tr. E.S. 1884, p. 319 (*murcalis*). Launceston; Deloraine.

Metasia, Gn.

liophæa, Meyr. Tr. E.S. 1887, p. 241. Mt. Wellington, 2,500 ft.; Launceston.

hemicirca, Meyr. Tr. E.S. 1887, p. 241. Launceston.

capnochroa, Meyr. Tr. E.S. 1884, p. 338. Hobart; Mt. Wellington; Launceston; Beaconsfield.

homophæa, Meyr. Tr. E.S. 1885, p. 449. Hobart; Deloraine.

Pyrausta, Schrank.

hyalistis, Low. Tr. R.S.S.A. 1908, p. 100 (*diplosticta*). Mt. Wellington, 2,500 ft.; Russell Falls; Launceston; Cradle Mt., 3,000 ft.; Burnie.

Mecyna, Gn.

ornithopteralis, Gn. Delt. & Pyr., p. 411. Hobart; Launceston.

Heliothela, Gn.

persumptana, Wlk. Tr. E.S. 1884, p. 344.

floricola, Turn. P.R.S.Q. 1912, p. 159. Cradle Mt., 3,000 ft.

Eclipsiodes, Meyr.

drosera, Meyr. Tr. E.S. 1897, p. 245.

Scoparia, Haw.

meyrickii, Butl. Tr. N.Z. Inst. 1884, p. 108. Hobart.

philonephes, Meyr. Tr. N.Z. Inst. 1884, p. 110. Rosebery; Strahan.

favilliferella, Wlk. Tr. N.Z. Inst. 1884, p. 111 (*encausta*). Hobart; Mt. Wellington, 2,500 ft.; Lake Fenton, 3,500 ft.; Bothwell; Ross; Wilmot; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.

anthracias, Meyr. Tr. N.Z. Inst. 1884, p. 74. Hobart; Russell Falls; Launceston; Wilmot; Burnie; Rosebery.

axiolecta, Turn. P.R.S. Vic. 1922, p. 53. Cradle Mt., 3,000 ft.

exhibitalis, Wlk. Tr. N.Z. Inst. 1884, p. 77. Hobart; Russell Falls; Bothwell; Strahan.

syntaracta, Meyr. Tr. N.Z. Inst. 1884, p. 77. Hobart; Mt. Wellington, 1-3,000 ft.; Russell Falls; Launceston; Wilmot; Burnie; Rosebery; Zeehan.

**synapta*, Meyr. Tr. N.Z. Inst. 1884, p. 78. Mt. Wellington, 2,500-3,000 ft.; Lake Fenton, 3,500 ft.

**perierga*, Meyr. Tr. N.Z. Inst. 1884, p. 80. Mt. Wellington, 3-4,000 ft.

**gomphota*, Meyr. Tr. N.Z. Inst. 1884, p. 80. Mr. Wellington, 2,000 ft.

**anaplecta*, Meyr. Tr. N.Z. Inst. 1884, p. 89. Mt. Wellington, 3,000 ft.; Cradle Mt., 3,000 ft.

spelæa, Meyr. Tr. N.Z. Inst. 1884, p. 89. Hobart; Russell Falls; Launceston; Deloraine; Wilmot.

**acropola*, Meyr. Tr. N.Z. Inst. 1884, p. 101. Mt. Wellington, 4,000 ft.

cleodoralis, Wlk. Tr. N.Z. Inst. 1884, p. 101. Hobart; Mt. Wellington, 2,500-3,000 ft.; Lake Fenton, 3,500 ft.; Bothwell; Launceston; Deloraine; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.; Rosebery; Zeehan; Strahan.

oxygona, Meyr. Tr. E.S. 1897, p. 381. Hobart; Rosebery.

plagiotis, Meyr. Tr. E.S. 1887, p. 247. Hobart; Bothwell; Campbell Town; Wilmot; Moina, 2,000 ft.; Rosebery; Zeehan; Strahan.

PTEROPHOROIDEA.

Pterophoridæ.

Platyptilia, Hb.

emissalis, Wlk. Cat. Brit. Mus. XXX., p. 930. Wilmot; Cradle Mt., 3,000 ft.; Moina, 2,000 ft.; Burnie.

Stenoptilia, Hb.

phæonephes, Meyr. Tr. E.S. 1886, p. 19. Mt. Wellington, 2,500 ft.; Wilmot; Moina, 2,000 ft.; Cradle Mt., 3,000 ft.; Rosebery.

zophodactyla, Dup. Cat. Brit. Mus. XXX., p. 944 (*canalis*). Cradle Mt., 3,000 ft.; Strahan.

NOTES ON THE JOURNAL OF CAPTAIN CHARLES O'HARA BOOTH.

Sometime Commandant of Port Arthur.

By

R. W. Giblin, F.R.G.S., F.R.C.I.

Plate XI.

(Read 9th November, 1925.)

(Communicated by Sir Alfred Ashbolt, Kt.)

A document of considerable importance has recently been presented to the Royal Society of Tasmania under circumstances which are not without a touch of romance. Perhaps it would be more correct to say that a copy of part of a very human document has been so made available for the use of the Society. The original manuscript is the private journal kept by Captain Charles O'Hara Booth, for some years Commandant of the Penal Establishment at Port Arthur, and afterwards Superintendent of the Queen's Orphan School, male and female, at New Town. (1)

Charles Booth was born on the 30th August, 1800, at Basingstoke, Hampshire, where his parents occupied a house of some importance in that neighbourhood. They were of that class in England, of good family, which presented its sons freely to the public services of the country, and was able in many cases to advance the interests of the children by the system of purchase in use in the Army of that day. An elder brother was in the Navy when Charles Booth began his military career, while a younger brother also entered that Service, and died as recently as 1898 with the rank of Admiral.

The journal was begun on the 5th of July, 1815—Waterloo year—when the youth set out for India in the hope of obtaining a commission in the Honourable East India Company's service. Things moved slowly in these days; the ship did not arrive at Calcutta till the 11th of January, 1816, and no Ensigncy was forthcoming till the following September, when he was appointed to the 53rd Regiment. Then followed some years of service, but a rude shock came in 1819,

[(1) Booth was appointed Superintendent of the Queen's Orphan School at New Town in 1844; *vide Gazette* of 15/3/1844. His appointment was confirmed by the Home authorities in *Gazette* of 24/1/1845. Booth remained in charge until his death, which occurred on 11/8/1851.—Ed.]

Figure 1.
Mrs. Charles O'Hara Booth.

Figure 2.
Capt. Charles O'Hara Booth.

NATIONAL MUSEUM MELBOURNE

when, with others, he was reduced to half-pay and compelled "in low spirits" to return to England. On the way thither, this also being a six months' voyage (April to October), a call was made at St. Helena, the inevitable visit paid to Longwood, and a reputed view of the fallen Emperor obtained. In December of that year his brother James, home on two days' leave from his ship, mentioned that a Second Lieutenant of the 21st Fusiliers wished to sell out. This was too good a chance to be missed, and a month later Charles Booth found himself an officer by purchase in that regiment. In 1821 he was stationed at Demerara, in British Guiana. It is uncertain how long he stayed there.

Now, an interesting feature of this journal is that the writer used the right-hand page only when making his chronological entries. When he came to the end of the book, which was thus only half filled in, he turned it round and wrote on the blank half of each opening, which had, of course, now become the right-hand page. For a certain reason this has had rather a disastrous result from a Tasmanian point of view. At some time someone has torn out from the book a number of pages. There is no apparent reason for this action; it may have been that the period so dealt with, April to December, 1826, covered a period that it gave little pleasure to recall. Be that as it may, the elimination of those pages had as a consequence a serious gap in the record of a later time, and the hiatus created happened to be from March, 1835, two years after Captain Booth became Commandant of Port Arthur, to January, 1836.

On their return from the West Indies the 21st Fusiliers were stationed at Windsor. On the 20th June, 1827, Booth writes, "Went to Ascot. His Majesty's entry to the course "one of the finest sights I ever witnessed—loudly cheered— "preceded by the Prickers—women lovely—and considerable "shew—should have regretted greatly missing the proceed- "ings." In 1828 Bath was the headquarters, and later in that year Fermoy in Ireland. It took several days' marching to reach the latter town from Waterford. One of those marches, a long and dreary one, caused the young Lieutenant to become irritable; "Damn the fellow," is the record in the journal, "damn the fellow who invented Bearskin caps—par- "ticularly in windy weather."

The regiment was in Mullingar in 1829 and Kilkenny in 1830. On the 16th of September of the latter year came

"the pleasing intelligence of Promotion by Purchase, thanks "to good fortune, a generous parent, and a dear sister. Paid "200 above regulation."

In 1831 the regiment was transferred to the Midlands. On its march thither from Liverpool Booth's detachment stayed for some days at Warrington, in Lancashire. The diary record of the 20th of October, 1831, is noteworthy. "After parade a party of us went on the railroad as far as "Newton by the 'Mary' steam coach, where it meets the "great Manchester train. At times we went a ¼ of a mile "in 23 seconds. Waited to see the Manchester train, which is "perfectly astonishing, and then returned." The excursion thus described took place only six years after the first public railroad in England was opened, between Stockton and Darlington. The seed sown that day in the writer's mind was to bear fruit in a humble way within another six years in a remote corner of the Empire. It is reasonable to suppose that the tramway between Long Bay and Norfolk Bay, (2) projected and begun by the Commandant in 1836, owed its origin to the experience gained in Lancashire.

A shock for the Fusiliers came in December, 1831, when they heard that beyond doubt New South Wales was to be their next station. Rumour was not far astray on this occasion. In July, 1832, Captain Booth was at home on two months' leave, before sailing for the Antipodes. An interesting entry is that of the 27th of that month: "Went over to Odiham to "see the arrangements of the Dinner to the Poor in Com- "memoration of the Passing of the 'Reform Bill'—went off "very well and arranged admirably."

On the 15th of September, 1832, Captain Booth, with his detachment, consisting of one Lieutenant, one Sergeant, and 28 men, left Deptford in the *Gloriana* bound for Hobart. Calling at Spithead they took convicts on board, but it was not till the 16th of October that a real start was made. The Lieutenant had to be left behind, being too ill for the journey. The ship made a good voyage, making her landfall at Port Davey on the 31st of January, 1833, anchoring that night opposite Green Island in D'Entrecasteaux Channel, and arriving at Hobart on the following afternoon.

The chief value of the journal as a Tasmanian historical document now comes into view. Booth's comments on pass-

[(2) Although all the timber, rails, etc., have decayed, the course of this railway can be traced plainly at the present day. The remains of the earthworks can be seen at many places, close to the road from Taranna to Long Bay—the latter settlement being now known as Oakwood, whilst the township at Port Arthur is known as Carnarvon.—Ed.]

ing events are short and to the point, nevertheless they will attract attention as affording a detail here and there of ways of life and of opinion about men in those days. His first remarks on landing are: "Waited on His Excel-"lency, the Lieut.-Governor, Col. Arthur. Strolled about the "town, a place that evidently will be before long of consider-"able size and consequence. Went off again to the ship, the "orders being very strict here; find that we shall not be "landed for several days—no Corps but the 63rd in this "Command at present—several good posts still kept up here "—but the golden days have fled."

However, Booth's luck was fairly good, for within a month after his arrival the Governor appointed him Commandant at Port Arthur, and he entered on a little kingdom which he made all his own, as his journal shows. While waiting for the brig that was to take him and his junior, Macgregor, to the penal establishment, there were several functions and social events for the officers. On the 28th of February a field day was arranged in honour of Her Majesty's Birth-day. A déjeuné at Government House surprised him: "Agreeably astounded," wrote the impressionable Booth, who was never able to resist a pretty face, "at the dis-play of the "Fair—a very nice party—but dispersed rather early." Arthur's parties generally came to an end too soon for this sociable soldier man. Constantly this trait, this admiration for the fair sex, peeps out in the journal (I have said that this is a human document), but it was not allowed to interfere with duty.

That Booth was satisfied with his new post is shown by his entry on the 16th of March, after his arrival at the Settlement: "Took over the command—quite pleased with "my charge," and on the following day he wrote: "St. "Patrick's Day—Lowes and Detachment came in from Mac-"gregor's post (at Eagle Hawk Neck), all dined with me, "and embarked, leaving me in Command of a very snug "(though responsible) post."

In that spirit Captain Booth took over charge and entered upon those heavy duties which were to try all his powers and to undermine his constitution before he relinquished his command eleven years later. Port Arthur was only in its third year as a Settlement when he first went there, and an enormous amount of constructive work still remained to be carried out to bring it to that state of polish and perfection as an ideal establishment for the punishment and correction of offenders that he so strongly desired and

aimed at. There is one thing that this newly appointed official must have made up his mind about, without mental reservations of any kind. He determined that he would never be found wanting in the way of personal exertions, physical and mental, but especially the former. Hard work he expected from others, those others being the free and the bond, guardians and guarded, who were his subjects, but then he was himself prepared to give his own hard work, fiercely hard work, to the good cause, the maintenance of absolute order and strict discipline.

* * * * *

It may not be amiss to digress here for a moment or two in order to glance at the manners, tendencies, and thoughts of the period when this soldier-commandant took over control of his post. The Reform Act had just been passed. That in itself marked a change in spirit compared with the previous century. Men were proposing to themselves to think in a more kindly way about their fellows and to act towards them in a more tolerant fashion. I refer to the governing classes, those in whose charge, to a great extent, hung the welfare, the health, the chance for any happiness in life, of the masses of the people. The harsh, cruel age of the previous hundred years had been found to be all wrong, unrighteous in fact. But laws and habits are not to be changed all at once, and those brought up during the first years of the 19th century could not be expected to alter their modes of thought and action in a moment. To invert an old saying: "Nobody becomes utterly benevolent "all at once," and public opinion prefers steady rather than rapid progress, knowing that reformers may be very unscrupulous at times. Least of all was it to be expected that the system of punishing those convicted of crimes, in prison ships, houses of correction or penal establishments, would be altered with ill-considered haste. Nevertheless the preaching of Wesley, the books of Howard the philanthropist, and the work of Wilberforce and of Mrs. Elizabeth Fry, were beginning to have their effect. These influences began to modify the ideas even of legislators, and the law which in 1827 made the use of man-traps and spring-guns illegal affords one proof of the working of a more liberal spirit. One historian, referring to a certain statesman's efforts towards reform, puts it thus: "Peel will be remembered for "many salutary changes during his tenure of the Home "Office (1822-1827, 1828-1830). He reformed the criminal "code (especially by drastically reducing the 200 offences for

"which capital punishment could be inflicted), and criminal "procedure; systematised the functions of juries; improved "the condition of the gaols; and established in London a "new police force." The same writer remarks later on: "The growth of a new feeling of refinement was shown "in the passing of an Act (carried in 1833 and two years "afterwards extended to the whole county), which made it "illegal to drive any ox or cattle, or to bait any bull, bear, "badger, or other animal, or to fight cocks within 5 miles "of Temple Bar."

Thus we see that in that first part of the nineteenth century the dingy figure of Justice had been subjected in England to a spring cleaning, and the bandage over her eyes, intended to blindfold her, rendered more effective for that purpose. We may be proud of the fact that the process has continued, but with increased vigour.

* * * * *

It was at such a time, then, that Captain Booth took command at Port Arthur. His training, like that of the Lieut.-Governor, had made him a strict disciplinarian, and a perusal of his journal will, I am sure, convince the reader that here was a firm, perhaps even a stern official, one determined to carry out his duties without departure from the rules and regulations fixed by the system. In other words, the Commandant was a servant of the system, and he felt it his duty to bend all others to the same code. It seems certain, however, that if he was compelled to be harsh in his treatment, he was equally desirous of being just under the terms and conditions of the system. Like Dr. Temple (3) and the schoolboy, if Booth appeared to the prisoners as a "beast," he was a "just beast." The conditions under which they were expected to live in the penal establishment were made known to the convicts. The consequences of departure from rules were explained to them. If they chose to err, then punishment, severe and strict, but according to the law, would certainly follow. Notwithstanding this, my own impression is that Booth was as kind to the unfortunate beings in his charge as it was possible for him to be.

To make himself a complete master of the situation the Commandant set himself to work to learn every detail about the geography of the peninsula. Not content with making a complete circuit by land, he took journeys by

(3) Afterwards Archbishop of Canterbury.

water in a whale-boat from the Settlement round Tasman Island to Eagle Hawk Neck, and from Wedge Bay round Cape Raoul to the Settlement. One land journey along the shore from Fortescue Bay to Eagle Hawk Neck, in 1834, is described at some length. It took four days to accomplish, and the party of three (it included the Doctor from the Settlement) was nearly exhausted from starvation when it reached the Blow-hole and "nearly eat Macgregor out of "House" at the Neck. The characteristic entries are as follows: "Found three parties had been sent out in all direc- "tions, with provisions, as we were given up—it afforded "me very infinite pleasure to see the interest that our "situation had excited—even to the most depraved of the "Prisoners," and again—"Found a number of gaol-birds, "but from the general good feeling evinced by the Prisoners "I gave them all a *Benefit*—not after the usual manner. I "omitted to mention that this last expedition completed my "tour of the Peninsula, *'per terrâ et mare'*."

The journal is in the main one long string of records of movement between the Settlement and outstations. In November, 1834, he felt so fit from the exercise of long inspection walks that he proudly recorded, after a 50-mile trip: "Open to the world for a cool £50 to go on foot the "distance of 50 miles, within 12 successive hours."

When, after some years, roads were improved, a riding horse was kept for some sections of the rounds, but walking continued to be the principal means of locomotion. A twelve-hour day must have been the average working day for the Commandant when on tour. It is evident, however, that he was not a good bushman; once off the track he seemed to lose direction, and he had several escapes from being lost. One such occasion will be referred to later.

A feature that will strike a reader of this journal is the choice made of descriptive expression. The writer preferred to use picturesque terms to express himself, if such could be found. The following are some instances: "Piscatorising with the Seine" means, of course, "fishing." "A Brace of Lads off for a Slaunt" signified the absconding of two convicts. "Walked into the Bowels of the Earth" was his expression for descending one of the coal mines started in his time (May, 1833). "Ration'd at the Com- "missariat" was his way of noting down that he had dined with the Assistant Commissary and his wife. "To operate "on flint and steel" pictured the lighting of a fire. In re-

ferring to punishment for some offence he wrote "Visited "them with appropriate rewards for their conduct." A "Peruke," by a play on words, indicated an official rebuke. This method of clothing the ordinary occurrences of a somewhat monotonous life of routine was probably resorted to in order to give a little colour, a something of variety in thought and word, to what might otherwise have seemed to the writer "a bald and uninteresting narrative." One is reminded of a person in a very different sphere of action, Dick Swiveller, who, as Charles Dickens has told us, "sought the "downy," while others merely went to bed, and who "had "some of the rosy," when his friends indulged in wine. That this officer of Fusiliers had a liking for poetry is shown by numerous extracts admired sufficiently to be copied into the journal, and there are indications that some verses were of his own composition.

Captain Booth could enjoy conviviality on certain occasions, but it must not be carried to excess, and he would express in his notes playful disapproval of any lack of restraint on the part of his associates. Opportunities for hospitality were more frequent than one would have expected, considering that Port Arthur from its position and its purpose was not easy of access. Visits of the Lieut.-Governors, Colonel Arthur and Sir John Franklin, are described, and the Commandant has recorded with justifiable satisfaction the praise expressed by those officials for the results obtained by his measures and by his efficient methods of control. Perhaps he enjoyed most of all having as guests brother-officers from the troops stationed at Hobart. But even on such occasions attention to regulations had to be observed, as the following entry shows: "22nd March, 1834. "Introducing Wharton (4) and La Motte to the Work Shops "—great difficulty in preventing the Rules being digressed "(a prisoner being at large, no shooting allowed)."

This intense determination to have the machinery of the system run smoothly and with the regularity of finest clockwork was bound to have its reactions when something occurred to disturb the balance. Here are three consecutive entries which should not be missed:

"28th Jan. 1837. Received communication enough to "break my heart after all my efforts."

"31st Jan. Heartbroken and miserable."

(4) Wharton was afterwards drowned at the mouth of Little Swan Port, July, 1837.

"1st Feb. My poor heart a little relieved, but still greatly "harassed."

Now these might be taken as cries from the soul of a man desolated by a deep personal loss, such as the death of a beloved one. What, then, are they in reality? In the case of Captain Booth, with his mercurial temperament and passionate ardour, they express his grief—and it is very personal—because two convicts had broken through the supposedly rigid barriers, natural and artificial, surrounding the penitentiary, and had succeeded in getting away to the mainland.

Booth could appreciate and encourage the efforts of ministers of religion for the benefit of those in his charge, as the following items, in characteristic vein, will show:—

"25th Nov., 1833. Cutter *Shamrock* came in with Messrs. "Backhouse & Walker, Quakers, travelling with authority, "to visit different establishments; provoked them to take "up their quarters with me—after Breakfast danced them "through the Settlement and up to Mt. Arthur.

"26th. Suspicious looking morning, but notwithstanding "ventured with my companions of the Society of Friends "to visit Eagle Hawk Neck—got there about 11 a.m., well "drenched—made a good blow out and came back.

"27th. Friend Backhouse delivered a very good Dis- "course to the Prisoners—no labour this afternoon for "that purpose.

"28th. Went to the Chasm near the Bluff—got back "just in time for dinner. Friends Walker and Backhouse "took leave—rather pleased with them."

It is of interest to note that G. W. Walker, describing that visit in his Journal (Life and Labours of G. W. Walker), makes this comment: "The system now adopted at "Port Arthur, notwithstanding its severity, leaves a door "open for the deserving, or those who evince a disposition "to conform to the regulations of the establishment."

The following entries, referring to the visit of another minister, must not be omitted.

"30th Sept., 1836. Dr. Browning arrived from Town.

"1st Oct. Dr. B. addressed the Prisoners at considerable "length and to the purpose.

"2nd. Oct. Service by Dr. B.

"4th Oct. Dr. B. visited Point Puer and catechised, etc. "Addressed the Prisoners again this afternoon. Got his "pocket picked whilst at Settlement School this evening."

It would seem, therefore, that the Doctor's discourse failed to have due effect on one at least of his hearers.

Sufficient has been said to prove the value of the journal as a record of service, but I should like to mention several items which, though no doubt well marked in official documents and even in the Press of the period, might properly be included in this sketch of Captain Booth's personal notes of his "sovereignty." Thus he mentions that on the 25th of April, 1836, Lieut.-Governor Arthur laid the foundation stone of the Church at Port Arthur. On the 26th of July, in the following year, he writes that the first Service took place in the New Church, although this was not quite finished. The Railroad between Long Bay and Norfolk Bay, a work suggested by him, has already been mentioned. Concerning the Coal Mines, which were first opened out and developed by Booth, a good deal is written. Innumerable visits to these were paid by him. Then telegraphic communication with Hobart by Semaphore was established during his command. This required genuine hard bush work, which Booth was not the man to delegate to others, in order to find the hills best suited for the purpose. He appears to have been keenly interested in Steganography, and I believe that a code of his own invention was used for the signals.

We now come to what must have been the most terrible, the most trying episode of Captain Booth's life, the experience he had when "bushed" on Forestier's Peninsula. This deplorable adventure happened in May, 1838. His notes, no doubt written after the event, and when recovering from the effects of exposure and hunger, show some confusion as to the dates, but that is not surprising. On the 24th of May he started out from the Settlement with his pack of dogs to visit the Whaling Station at Blackman's Bay. Getting as far as the Sounds, he and the convict servant with him "bivouac'd" in the bush. On the 25th, after the dogs had hunted a kangaroo, the two men lost their way. During this day the servant managed, perhaps purposely, to get separated from his master. Food was finished, and Booth, not a good bushman, found himself in difficulties and was compelled to camp in a swamp. As rain had set in he was unable to light a fire, and being lightly clad the situation was serious. Then followed two days of misery, his state becoming worse and worse from lack of food and warmth,

the nights at that time of the year being extremely cold. He hardly expected to survive through the night of the 27th. On the 28th his condition was pitiable; he had lost the use of his feet and his hands, and having been without food for fully three days his strength had given out, yet he did manage with a supreme effort to crawl down a hill and to extricate himself from the depths of the dense bush he had occupied the previous day. At noon he heard gun shots and a bugle, and at three o'clock that afternoon he was found by one of the numerous rescue parties that were searching the peninsula in all directions.

In reality he owed his escape from death to his dogs, which had stuck to him all the time, and when the rescue party came in sight attracted its attention. It was impossible to move the sufferer that night, so he was made as comfortable as possible in a sheltered spot. Next day a litter was obtained from Dr. Imlay's hut at Lagoon Bay, about three miles away, and he was carried there. He was then transported by boat to East Bay Neck, and by another boat to Norfolk Bay, and so by the tram-line to the Settlement.

Captain Booth finished his record of this event with these words: "Altogether I received such marks of good "feeling towards me and generosity of Heart—that words "can scarcely express my feelings, and when the bustle sub- "sided and I was once again reclined in my humble apart- "ments were these feelings less exhibited by my faithful "servant and his family—whose anxieties had been very "great. The good feeling also represented to have been "evidenced by the Prisoners and wretched little Boys at "Point Puer also speaks greatly in behalf of their still pos- "sessing some latent sparks of good—which, if only worked "on firmly and rigidly, yet kindly—much good, it is to be "hoped, may be done."

It is worthy of note that Lady Franklin, in a letter to her sister, dated the 21st June, 1838, and one of the series that has lately come into the possession of the Royal Society, makes this reference to the episode:—

"On the evening of the ball news was brought up from "Port Arthur (a penal settlement of great interest and "importance) that Captain Booth, its Commandant, had been "four days missing in the Bush, and it was supposed had "perished. The two Military Officers under him, stationed "at different outposts of the settlement, were on leave of "absence for different reasons, and that night at the ball, "so that the settlement (containing a large number of con-

"victs of the worst description with only 50 soldiers to "control them) was left without any head except that of a "sergeant and a Deputy Commissary, the former having the "sole command of the troops. Great was the consternation "this news occasioned, not only on account of the extra- "ordinary merit of Capt. Booth, but on account of the prob- "ability of the convicts rising *en masse* under such favour- "able circumstances; our early disappearance from the ball "was attributed to this circumstance, for rumours of the "disappearance of Capt. Booth had been conveyed to his "junior officers at the ball room in some pencil lines written "from the settlement, before the telegraphic notice, or any "other, had reached Sir John's ear.

"The two young officers were sent for from the ballroom "—the *Colonial* schooner was ordered to prepare for sailing "at dawn of day—and these, another officer with a rein- "forcement of 30 soldiers, and buglemen for the bush, were "dispatched on board of her. The next morning the Tele- "graph said that Capt. Booth was found, without stating "whether dead or alive, and in this ignorance, but with "every hope of his being safe, the *Conway* frigate (fresh or "jaded from the ballroom) set sail for Sydney, proposing to "put into Port Arthur on her way. In the course of the "day we learnt to our great delight that Captain Booth "had been found *alive* in the bush, where he had lost his way "apart from his convict companion, who, having been pun- "ished a few days before, it was suspected had murdered "him. He was frost bitten and deplorably weak, having "been without food or drink for four days, unable to fire his "pistols, or to answer the coo-ies (the usual bush cry) or the "bugles which occasionally reached his ear. His Kangaroo "dogs, which were his faithful companions, acted for him, "*they* heard and answered the bugles, and brought the pur- "suers to the rescue.

"Sir John has laid a strict injunction, or, rather, *com- "mand* on Capt. Booth never to go into the bush again un- "accompanied by an orderly to watch his footsteps; for, what "with his daring, fearless nature, and his absence of mind, "which is always at work upon the interests of the settle- "ment (wherever he may be in the body), this is the third "or fourth time the same accident has happened to him."

I do not know to what extent Capt. Booth carried out the injunction so considerately laid on him for his own sake by Sir John Franklin. We may safely assume that after such an experience he would take far greater care in future

expeditions, and this for another reason than the Governor's command, namely, the influence and will of a still higher authority.

The journal closes abruptly on the 29th of August, 1838, but the last pages describe a visit to Hobart, and it was during those few days that he became engaged to be married. (5) I think we may close this review with a final extract, that of 8th of August. "Had a most delightful ride as far "as O'Brien's Bridge, escorting L. Once happy in my life. "Came across Sir John; obliged him to side for it, a capital "old fellow. Dined at Government House."

* * * * *

It only remains now to relate how it came about that Extracts from Captain Booth's journal were made available for the Royal Society. I have given elsewhere (6) an outline of the occurrence, but as, for certain good reasons, no names whatever were then mentioned, the story here set forth is new in the sense that it is now furnished with the details that properly belong to it. It will be admitted, I think, that it is not lacking in that touch of the romantic which manifests itself for our benefit and our enjoyment when the present and the past, each with its own ideas and impulsions, are brought into association. Illuminating the present little instance of the process, there is the thought that it is what we ourselves bring to our studies of the past that to some extent secures for us the fascination we find in them.

One day in the summer of 1923 Major J. A. Richmond, formerly of the South Staffordshire Regiment, who fought in East Africa in the Great War, was seated in his Club in Pall Mall. He was turning over the pages of an illustrated paper, when he came across the picture of a ruined church. It was the church at Port Arthur. It flashed across his mind that he knew something about that building, for the laying of its foundation stone was referred to in his great-uncle's diary. This journal had only come into his possession a couple of years before, having been bequeathed to him by his great-uncle's daughter, Miss Amelia Patricia Booth, (7) who was born at Port Arthur on the 25th of August, 1839.

[(5) Captain Booth married Miss Elizabeth Charlotte Eagle at Hobart on 20/11/1838.—Ed.]

(6) *United Empire*, December, 1923.

[(7) Miss Booth visited Tasmania in 1909, and upon her return to England she sent out to the Society the Signal Book compiled by and used by Captain Booth at Port Arthur.—Ed.]

She had died in September, 1920, and although he had been too busy to study the book closely he had skimmed through it, and remembered the reference to the church.

Then Major Richmond began to consider. The journal was, of course, a private family record. There were parts of it which were of a purely personal nature. But other parts, those, for instance, dealing with the years spent as a Commandant at Port Arthur, surely might be of some historical value for all in Tasmania who cared for such things. At any rate, it should be easy to find out if that was so. Thereupon Major Richmond went to the Tasmanian Government Office and offered to lend the book to the Agent-General in order that any sections of it relating to Tasmania might be copied out. This opportunity was eagerly seized by Mr. Ashbolt, who saw at once that such a work might contain quite important matter, and that the private views of an official placed in a very responsible position would be a welcome and useful supplement to the public documents of the period covered by the diary, that is, from 1832 to 1838. There was another feature of the case that attracted, one might almost say, excited, the Agent-General. Major Richmond's proposition nearly coincided with the very handsome donation of Franklin Papers, the second of its kind, made by Mr. W. F. Rawnsley to the Royal Society. This feeling was enhanced, when it was noticed, as happened at once, that in one of Lady Franklin's letters to her sister there was a reference to Capt. Booth. What she had to say about him has already been stated. Major Richmond was pleased to have the copy of that letter, which was offered to him.

Following in Mr. Rawnsley's footsteps, the owner of the journal desired that any extracts taken from it should be presented to the Royal Society. It fell to the lot of the writer of these "Notes" to make those extracts, and as he read the whole diary and received permission from Major Richmond to utilise any passages and episodes in it other than those associated with Tasmania, it will be easily understood how and why the "Notes" came to be written.

EXPLANATION OF PLATE XI.

Figure 1.

Mrs. Charles O'Hara Booth (formerly Miss Elizabeth Charlotte Eagle).

Figure 2.

Captain Charles O'Hara Booth, 21st R.N.B. Fusiliers. Photograph taken from oil painting in the Tasmanian Museum. On the back is written, "Capt. Booth, 21st R.N.B. "Fusiliers. Painted 1836 by T. J. Lempriere, Dept. Assist "Coms. Gen."

Apparently both portraits were painted by Mr. Lempriere at Port Arthur, Capt. Booth in 1836, and Mrs. Booth at a later date. The paintings are the property of Mr. Bernard Walpole, who placed them on loan for exhibition in the Tasmanian Museum and Art Gallery.

NOTES ON SOME RARE AND INTERESTING CRYPTOGAMS.

By

L. Rodway, C.M.G.,

Government Botanist, Tasmania.

(Read 9th November, 1925.)

Among the enthusiasts who have pushed the study of plants to its present high level, few have done much research amongst the lower groups, especially the fungi. Little more has been done than could be classed as simply scratching the surface. There is plenty of new material at hand ready for the worker. The only trouble is that sometimes when returns are copious it is not always easy to induce an estimable society to publish it.

The plants brought before you in the present paper are of exceptional interest, though few. The Hepatics here described by Pearson are the last lot collected by our old friend, W. A. Weymouth. Pearson, who died only a short time ago, was for many years a corresponding member of this Society.

Terfezia tasmanica, n.s. An irregular subterranean tuber, just emerging from the ground when mature, usually 1-3 cm. diameter, chestnut-brown, tough fleshy. Pileus with an obsolete stem piercing the centre of the tuber, tough fleshy, made up of bold convolutions with thick walls opening at the base by the side of the stem. Hymenium lining the internal surface of the convolutions. Asci 8-spored, globose-pyriform, minutely echinulate, coat thick, forming a double contour, hyaline till old, then brown, 20 μ. diameter.

Slopes of Mt. Wellington, 300 ft.

Xylaria tolosa, n.s. Sporophore usually arising with a long root from a loose subterranean sclerotium; erect, black surface, white and dense internally, about 4-6 cm. tall, the sterile stem rather flat at least when dry, about 2-3 cm., slender; fertile portion slightly thickened about 1-5 cm. Perithecia small, immersed, only the osteoles protruding; apex attenuated and sterile; asci narrow, cylindric, 8-spored; spores black, ellipsoid, oblique, smooth, 13 x 6-7 μ.

Near to *X. deceptiva* of Lloyd. Located at Tolosa, also at Morialto Gorge, near Adelaide.

Gymnomycis megasporus, n.s. Tuber about 1 cm. diameter, rugose, brown to pale, rather dense; gleba pale, peridium absent, tubes small, much contorted. Spores globose, hyaline, surface of a dense coat of short clubs, 15-20 μ. diameter.

No doubt near *G. seminudus*, but complete absence of peridium, the dense coat of short clubs, and size of spores make it very distinct.

Melanobotrys, n.g. Perithecia sessile on a divided tree-like stem arising from an enlargement of the bark of the tree, black, the perithecia globose, free, 0.5 mm. diameter, no osteole; spores dark brown, smooth, uniseptate, 12 x 3 μ.

Melanobotrys tasmanicus, n.s. Growing on a gall expanded on the stem of *Nothofagus cunninghami;* the branches about 5-8 mm. high. Apparently the fungus perennates in the surface wood, causing a pulvinate enlargement.

West Coast, on stems of *Nothofagus.*

Hyphoscypha coccinea, n.s. Discoid, obtuse, margin thick, waxy; disc orange-red, slightly concave, 2-6 mm. diameter, margin and external surface pale, covered with short hyphal protuberances. Asci linear cylindric; spores eight uniseriate, oblong, obtuse, at first hyaline, smooth, 16 x 8 μ. When mature rather larger and armed with coarse asperities.

On rotten wood, National Park, 1,000 ft. altitude.

Hyphoscypha is pretty close to *Dasyscypha*, but differs by the external surface being rough with hyphal protuberances, instead of spreading cottony hairs.

Amongst Hepatics besides the new species forwarded by Pearson I desire to record the great variability of *Aplozia* (*Solenostoma*) *rotata*, Mitton.

Aplozia (*Solenostoma*) *rotata*, Mitt., is consistent in structure, but in colour and size varies greatly, according to surroundings. It is common for the tips of the branches to be deep red, but when growing in shade it is uniformly green. In exposed places on Mt. Wellington, also on Blue Tier, it is deep red and small, with leaves often less than half a millimetre diameter, but at Lake Petrarch and Snug River it is vivid green, and leaves often exceeding two millimetres.

This difference in size of leaf would be of little interest if happening to the organs of one of the higher plants, but mosses and fungi are supposed to be more uniform in size, and many a new species has been recorded for less distinction than occurs in this species.

In the Kew Bulletin No. 2, 1924, there appeared a paper on Tasmanian Hepatics by Mr. Pearson, in which are described some new varieties and species. It may interest local students if a short reference to these is made.

No record of most localities is made.

Lophocolea heterophylloides, Ness. This is admittedly a very variable plant. Pearson marks two forms as being distinguished from the type. Var. *decurrens* distinguished by its larger and very decurrent leaves, and some stems appearing to be winged, and its large underleaves.

Var. *macrocalyx*. Only differing from var. *decurrens* in having a very large involucre.

Symphyomitra wcymouthii, Pearson. Sterile, small, pale green, whitish below, loosely cæspitose. Stem prostrate, simple or slightly branched, very tender, antical side plane, postical rounded, 8 x 6 and 6 x 4 cells, cortical cells similar to the inner; branches lateral, slightly postical, arising from below the leaf, radiculose, rhizoids hyaline, straight, ascending to apex of the stem; flagelliferous, flagellæ postical microphyllous, radiculose. Leaves horizontally inserted, imbricate, slightly concave on plane, broadly ovate, oblong-ovate or roundish-oblong-quadrate, entire or retuse, upper (postical) margin extending to middle of the stem, lower leaves smaller bifid; cells medium size, 4-5-6 sided; walls thin, no trigones.

Dimensions: Stem, 1.3 to 2.5 cm. long; diam., .2 mm., with leaves 2.25 mm. wide; leaves, 1.5 mm. x 1 mm., 1.25 x .9 mm.

Lophocolea bicuspidata, Pearson. Monœcious, medium size, dark to dull green in colour, loosely cæspitose. Stems irregularly and sparingly branched. Leaves sub-opposite horizontal to patent, antical margin long decurrent, straight or slightly curved, postical margin, curved long triangular, margin entire, apex 5-6 times narrower than the base, bicuspidate segments acuminate, upper larger than the lower, sinus rounded; texture delicate, cuticle slightly papillose; cells medium sized quadrate, walls thick, trigones minute. Underleaves large, connate, with both leaves or one only,

rarely free, broadly cuneate or subquadrate, rather broader than high, bifid to about 1/3, sinus rounded, segments with two or more teeth on the exterior sides.

Perianth projecting a little beyond the bracts, oblong, trialate, wings broad, spinulose-dentate, mouth spinulose-dentate.

Plagiochila hartziana, Pearson. Dicœcious. Medium size, dark brown in colour, cæspitose. Stems simple or slightly branched, firm. Leaves alternate, imbricate or approximate, horizontal, broadly ovate or rotund, entire or with from 1-4 acute teeth, lower margin very decurrent, usually straight, upper margin rounded, ampliate, extending to the middle of the stem, only slightly decurrent, apex rotundate or acute (unidentate) or with several teeth extending to the upper margin; cuticle smooth, polished; cells medium 4-5-6 walled; walls firm, angles thickened, no trigones.

Metzgeria concavula, Pearson. Dicœcious, small, pale green, densely stratose-cæspitose, corticolous. Fronds repeatedly dichotomous, angle patent, margin much decurved, almost revolute, wing 12-celled, wide, rarely 15-20, sparingly setose, margin setose, setæ in pairs, more rarely single, straight or some nearly hamate, somewhat short and coarse, costa narrow, slender, two antical and two postical cortical cells; on cross section somewhat rather broadly oval, 4-6 cells; near the fork postical cortical cells 3 setose, densely so on some portions of fronds; cuticle slightly papillose. Calyptra long clavate, pilose. Gemmæ abundant, marginal or rarely on the postical side of costa, usually oval-ligulate, but various in shape, disciform or stipitate, but all more or less remarkably concave. Apart from the gemmiferous character of the plant, it differs from *M. nitida*, Mitt., which has also a costa of two antical and two postical cortical cells, by its less transparent cells, thickened walls, smaller trigones, presence of setæ on the wings, hardly papillose cuticle, shorter and stouter setæ; in *M. nitida* they are very long and delicate.

As Mr. Pearson quotes *M. nitida* of Mitten, it may be well to include, from Prof. Evans, the greatest authority of the genus, the following note:—

> I am unable to separate *M. nitida*, Mitt., from the widely distributed *M. hamata*, Lindb. In a paper on Chilian *Metzgeriæ* I have definitely reduced *M. nitida* to synonymy under *M. hamata*. There seems to be no reason for recognising the validity of *M. nitida*.

NOTES ON TASMANIAN ARANEIDÆ

(With a description of a new species).

By

V. V. Hickman, B.Sc. (Tas.).

Plates XII.-XV. and Seven Text Figures.

(Read 9th November, 1925.)

In the following notes I have adopted the method of description employed by Rainbow and Pulleine in their excellent account of Australian Trap-door Spiders (D), and can only hope that my descriptions will be as clear as theirs are.

Family AVICULARIDÆ.

Sub-Family *DIPLURINÆ*.

Group Diplureæ.

Genus *Chenistonia* (Hogg).

Chenistonia trevallynia, sp. nov.

Plates XII. and XIII.

The genus *Chenistonia* was established by H. R. Hogg, in 1901 (A), for the reception of two species which he found at Macedon, Victoria. Since that date, five other Australian species have been described, making a total of seven, namely:—

Chenistonia maculata (Hogg) }
Chenistonia major (Hogg) . } .. .. (A)
Chenistonia tepperi (Hogg) .. .. (B)
Chenistonia hoggi (Rainbow) }
Chenistonia girault (Rainbow) } .. .. .. (C)
Chenistonia auropilosa (Rainbow and Pulleine) }
Chenistonia villosa (Rainbow and Pulleine) } (D)

The following notes deal with a Tasmanian spider of this genus. The writer believes that it is a new species, and also that it is the first member of the genus *Chenistonia* to be recorded from this State. The name, *Chenistonia trevallynia*, is suggested, from the locality where the specimens were obtained.

The description of the male is as follows:—

Measurements in millimetres (excluding the falces).

Length of Cephalothorax	4.9
Breadth of Cephalothorax (across fovea)	3.7
Length of Abdomen	4.3
Breadth of Abdomen	2.8

Leg	Coxa	Trochanter and Femur	Patella and Tibia	Metatarsus and Tarsus	Total
1	1.8	3.6	4.3	3.7	13.4
2	1.5	3.2	3.5	3.7	11.9
3	1.2	2.6	2.8	3.3	9.9
4	1.6	4.0	4.3	4.6	14.5
				Tarsus	
Palpi	1.7	2.6	2.8	0.9	8.0

Cephalothorax: Obovate, dark brown, arched, and sparingly covered with fine, short, down-lying, black hairs.

Pars Cephalica: Narrow in front, gently ascending, smooth. The segmental groove is distinct.

Ocular Area: This forms a well-defined tubercular eminence, 0.7 mm. broad, and 0.5 mm. long. In front of it projects a tuft of six or seven long black bristles. Behind the front median eyes, and between the rear median eyes, there is another tuft of shorter bristles.

Clypeus: Narrow and brown in colour.

Pars Thoracica: Arched and broad, with distinct radial grooves.

Thoracic Fovea: Deep, straight, and situated two-thirds of the length of the cephalothorax from the anterior end.

Marginal Band: Narrow, fringed with a few scattered hairs.

Eyes: Set on an oval prominence, which is black in colour, and one and a half times as broad as it is long. They form a very compact group. The front median eyes are separated from each other by a distance equal to one-third of their individual diameter. The front laterals are the largest of the group, and have a long diameter equal to one and a half times that of the front median eyes, from which they are separated by a distance equal to one-fifth of the diameter of the front median eyes. The front row is procurved, while the rear row is recurved. The long diameter of the rear laterals is slightly less than that of the front laterals, and is equal to that of the rear median eyes. The rear laterals just touch the nearest point of the front laterals, and of the rear median eyes, and the black rims, on which these eyes are mounted, merge into one another between the eyes. *See fig.* 1.

Fig. 1. *Chenistonia trevallynia.* Eyes in male.

Legs: Similar in colour to the cephalothorax. They are densely clothed with dark hair, but on the upper side of each patella there is a bare longitudinal stripe. Spines are present on legs 2, 3, and 4, and are especially numerous on the metatarsi of legs 3 and 4. In the case of leg 1 there are only a few spines on the upper side of the femoral segment, while the tibial segment carries the apophysis, and powerful spine so characteristic of the genus. Near the base of the apophysis there is a second smaller spine. *See fig.* 2. This second spine was present in each of the nine

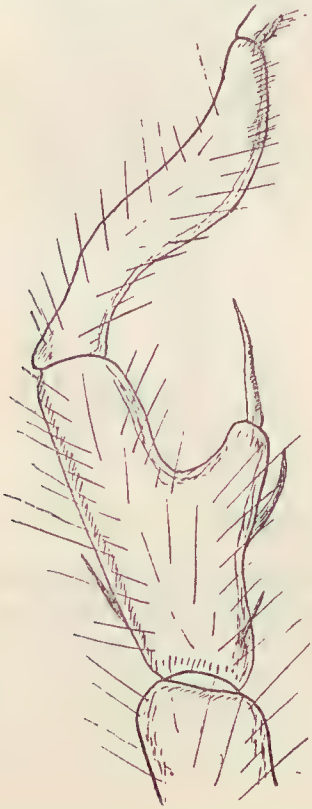

Fig. 2. *Chenistonia trevallynia.* Tibia and metatarsus of leg 1 in the male.

males examined. One abnormal specimen had a powerful double spine rising from the apophysis on the tibia of the right leg, and no spine at all on that of the left leg. The tarsi and metatarsi of legs 1 and 2 are scopulated. No spines are present on any of the tarsi. The superior claws are pectinated in two rows, there being about nine teeth in the inner rows, and twelve in the outer rows. The inferior claw is short and bare.

Palpi: Concolorous with the legs and thickly covered with hairs. The tibial segment is provided with spines and coarse bristles. The bulb is pyriform, and ends in a sharp point. Near the extremity, and on one side, there is a sharp thorn-like projection. *See fig.* 3.

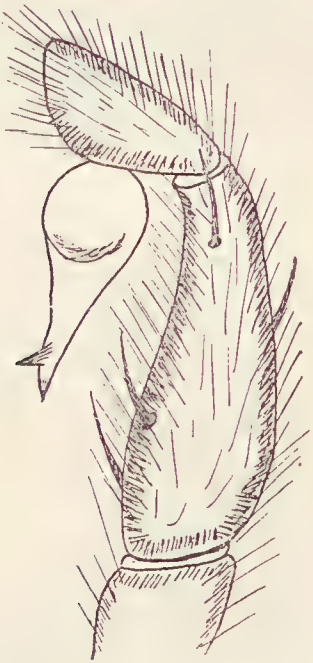

Fig. 3. *Chenistonia trevallynia.* Left palpus of male viewed from outer side.

Falces: Concolorous with the cephalothorax. Densely clothed with fine black hair and coarse bristles. No rastellum is present. The fang is long, well curved, and of a dark red-brown colour. The inner edge of the falx sheath is armed with a row of eight large teeth, and there are five or six minute intermediate teeth near the base.

Maxillæ: Light brown, not very broad, excavated round the labium, and in the excavation there is a cluster of about 37 short blunt spines. The heel is rounded. The beard is red.

Labium: Submerged, devoid of spines, but clothed with long coarse hairs. The apex is slightly rounded.

Sternum: Oval, arched, hairy, and fringed with black bristly hairs.

Sigilla: Very small, marginal, and not well defined.

Abdomen: Light brown mottled with dark brown, and thickly covered with long black hair. The under surface is fawn in colour, and covered with short black hair.

Spinnerets: Yellow and hairy. The superior pair long and tapering. The second segment is the shortest, while the first segment is equal in length to the third. The inferior pair are short, cylindrical, and about their own individual diameter apart.

The description of the female is as follows:—

Measurements in millimetres (excluding the falces).

Length of Cephalothorax	4.4
Breadth of Cephalothorax (across fovea)	3.4
Length of Abdomen	6.4
Breadth of Abdomen	4.3

Leg	Coxa	Trochanter and Femur	Patella and Tibia	Metatarsus and Tarsus	Total
1	1.9	3.6	3.7	2.8	12.0
2	1.7	3.2	3.2	2.6	10.7
3	1.4	2.8	2.6	3.0	9.8
4	1.7	3.9	4.1	3.9	13.6
				Tarsus	
Palpi	1.7	3.1	2.6	1.4	8.8

Cephalothorax: Lighter shade of brown than in the male; longer than broad, rounded at the sides, and thinly covered with short black hairs.

Pars Cephalica: Narrow in front, and gently ascending at the sides.

Ocular Area: Forms a well-defined oval eminence as in the male. It is 0.8 mm. broad, and 0.6 mm. long, and pro-

vided with a tuft of bristles in front of the anterior median eyes, and another tuft between the rear median eyes.

Clypeus: Narrow and hyaline.

Pars Thoracica: Broad, arched, radial grooves well defined.

Thoracic Fovea: Deep, straight, and situated as in the male.

Marginal Band: Narrow and without any distinct fringe.

Eyes: Arranged in a compact group on a raised tubercle as in the male. The front median eyes are the smallest of the group, and are separated from each other by a distance equal to half their individual diameter. The front laterals are the largest of the group, and their long diameter is equal to twice the diameter of the front median eyes, from which they are separated by a distance equal to one-third of the diameter of the front median eyes. The front row is procurved, while the rear row is recurved. The long diameter of the rear laterals is equal to about four-fifths that of the front laterals, and the long diameter of the rear median eyes is equal to one and a fifth times the diameter of the front median eyes. The rear laterals almost touch the nearest point of the front laterals, and of the rear median eyes; and the black rims, on which these eyes are mounted, merge into one another between the eyes. *See fig.* 4.

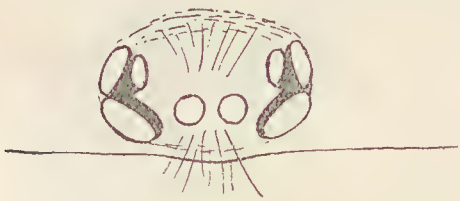

Fig. 4. *Chenistonia trevallynia.* Eyes in female.

Legs: Concolorous with the cephalothorax, moderately hairy. All of the metatarsi are furnished with spines, but those of legs 3 and 4 more densely so than the others. There are no spines on the tarsi. A scopula is present on the tarsi of legs 1 and 2. On the upper surface of each patella is a bare, light-brown, longitudinal stripe. The superior tarsal claws are pectinated in two rows; there are seven teeth in each row. The inferior claw is small and bare.

Palpi: Moderately strong and long. They are similar in colour and clothing to the legs. The tarsal segment is thickly scopulated, and provided with a single claw, having five pectinations.

Falces: Concolorous with the cephalothorax or darker; clothed with black hairs and coarse bristles. The inner ridge of the falx sheath is armed with a row of eight large teeth, and there are five or six minute intermediate teeth near the base. The fang is long, shining, and well curved. It is dark brown in colour. There is no rastellum.

Maxillæ: Light brown, not very broad; excavated round the labium, and in the excavation there is a cluster of about 37 short blunt spines. The heel is well rounded, and the beard reddish in colour.

Labium: Submerged, devoid of spines, but clothed with long coarse hairs. It is separated from the sternum by a groove.

Sternum: Light brown, arched, and hairy, fringed with short black bristles.

Sigilla: Small, round, marginal, distinct in mature specimens, but scarcely visible in young specimens.

Abdomen: Oval, light brown, mottled, with irregular dark brown spots and blotches. Thinly clothed with short and long black hairs. The anterior portion of the abdomen slightly overhangs the base of the cephalothorax. The lower surface is fawn in colour, and marked with two transverse rows of irregular brown spots.

Spinnerets: The superior pair are yellow, hairy, and tapering. The second segment is the shortest, while the first and third are about equal in length. The inferior pair are small, cylindrical, and slightly more than their own individual diameter apart. They are also yellow and hairy.

Locality: Trevallyn, Launceston, 11th September, 1925.

Field Notes: This spider makes a web under stones and logs, usually in damp localities. The web is a silken tube, which frequently branches into crevices in the ground, or in the log. Terrestrial Amphipoda, which are plentiful in damp situations, seem to form the chief food of these spiders. The male is usually found without a web, but sometimes constructs a tubular retreat under a log, just as the female does.

Family AVICULARIDÆ.

Sub-Family *MIGINÆ*.

Genus *Heteromigas* (Hogg).

Heteromigas dovei (Hogg).

Plates XIV. and XV.

The female of this species has been described by Hogg (E), who based his description on two specimens from Table Cape. The spider, however, is also found in the vicinity of Launceston. The male of the species is very seldom seen, and has never been described. The following account of a single specimen in the writer's collection may therefore be of interest.

Measurements in millimetres (excluding the falces).

Length of Cephalothorax	5.00
Breadth of Cephalothorax (across fovea) ..	4.75
Length of Abdomen	6.00
Breadth of Abdomen	4.00

Leg	Coxa	Trochanter and Femur	Patella and Tibia	Metatarsus and Tarsus	Total
1	2.1	6.0	6.0	5.2	19.3
2	1.9	5.2	5.0	5.0	17.1
3	1.6	4.0	4.0	4.0	13.6
4	1.7	5.5	5.5	7.0	19.7
				Tarsus	
Palpi	1.4	4.6	4.7	0.9	11.6

Cephalothorax: Slightly longer than broad; wide in front, but narrow posteriorly.

Pars Cephalica: Dark brown, almost black in colour; rounded in front, and does not rise so abruptly from the thoracic fovea as in the female; segmental groove distinct but not deep.

Ocular Area: Extends more than half the width of the front of the cephalic part. Its breadth is more than twice its length. The front median eyes are on a slight elevation.

Clypeus: Wide, transversely wrinkled, and provided with a few short bristles.

Pars Thoracica: Moderately broad across the fovea, but becomes narrow posteriorly. It is slightly arched; the radial grooves are well defined. A few black hairs are visible, but the greater part of the surface is smooth and hairless. The colour is light reddish-brown.

Thoracic Fovea: Deep, wide, slightly procurved in the centre, with a tendency to recurvature at the ends.

Marginal Band: Broad and fringed with short black hairs.

Eyes: The front median eyes are separated from each other by slightly less than their own individual diameter, and from the front laterals by four-thirds that distance. The front laterals are poised obliquely, and their long diameter is slightly less than that of the front median eyes. The front row is slightly procurved, while the rear row is distinctly recurved and shorter than the front row. The long diameter of the rear laterals is a little more than two-thirds that of the front median eyes; while the long diameter of the rear median eyes is a little less than two-thirds that of the front median eyes. The distance separating the nearest points of front and rear laterals is equal to half the long diameter of the rear laterals; and slightly less than this distance separates the rear median eyes from the rear laterals. *See fig.* 5.

Fig. 5. *Heteromigas dovei* (Hogg). Eyes in male.

Legs: Tapering, brown in colour, thinly clothed with bristly hairs. Two longitudinal bare stripes are visible on the upper surface of the femur, patella, and tibia of each leg. There are no spines on the upper surface of any of the legs. Two small spines are present on the outer side of tarsi I. and II., none on tarsus III., and only a single small spine on the outer side of tarsus IV. The metatarsal and tibial segments of all the legs are bespined on the sides. In the case of metatarsi I. and II., there are about ten curved spines in a double row on the outer side, and on the inner

side a pair of spines near the distal end, a pair near the base, and two single spines in between. Three spines are present on patella I., one on II., and none on III. and IV. The femoral segments are quite devoid of spines. The superior tarsal claws have eight teeth in a single row; the inferior claw is minute and smooth.

Palpi: Long, similar in clothing to the legs, but no spines are present. The tibial segment is long and slender, and is more than five times the length of the tarsal segment. The bulb is large, and almost spherical. It is produced into a sharp, thin, well-curved style. *See fig.* 6.

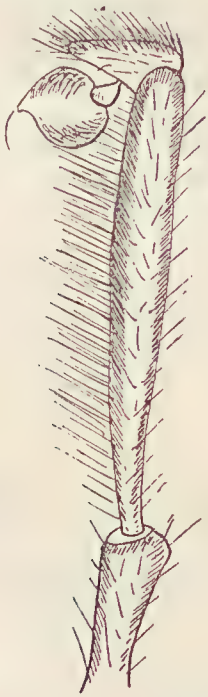

Fig. 6. *Heteromigas dovei* (Hogg). Left palpus of male viewed from outer side.

Falces: Short, very dark brown, almost black, in colour; they do not fall perpendicularly after a short horizontal portion as in the female, but slope gradually forward and downward in a gentle curve. The fangs are very strong, being reinforced with four ridges as in the female. There are four teeth on the outer, and four on the inner edge of the furrow, and five or six small intermediate teeth.

Maxillæ: Reddish brown, strong, broad; the lower outer corner rounded; no spines are present; the beard is red.

Labium: Slightly longer than broad, rounded in front, separated from the sternum by a well-defined groove; dark brown in colour, clothed with a few short black hairs, and with several long hairs at the apex. No spines are present.

Sternum: Pyriform, yellow, lightly clothed with black hairs.

Sigilla: The posterior pair are large, and placed near the central line. The other sigilla are not distinct.

Abdomen: Obovate, longer than broad, the anterior portion slightly overhanging the cephalothorax. The upper surface is dark grey, and clothed with black hairs. No patern is visible. The lower surface is yellow, and clothed with black hairs.

Spinnerets: Yellow and hairy; the superior pair are short, and appear to consist of only two segments. The first segment makes up almost the whole length, the second segment is reduced to a ring, and the third consists of a small dome sunk in the ring-like second segment. The inferior pair are small, cylindrical, and about one and a half diameters apart.

Locality: Mulgrave Crescent, Launceston, 4th October, 1925.

Field Notes: The male of this species was found under a stone in close proximity to the nests of several females. These nests are about 13 mm. in diameter, and go down almost vertically to a depth of about 220 mm. They are closed with a thin, neatly bevelled lid, and lined just inside the opening with a thin covering of silk. The lid is kept shut during the day time, and on attempting to open it the spider is sometimes found holding on to the inner side. Although there is no rastellum in this species, the female is able to dig a hole in the ground very quickly by means of the double rows of strong curved spines on her front legs. As soon as sufficient earth has been excavated to allow the spider to get into the hole, the building of the lid is commenced. The spider works inwards from the margin of the hole, gradually closing the opening with concentric rings of earth cemented together with silk. This cover is strengthened with layers of silk on the inside. It is then cut away

round the margin, leaving a hinge on one side. When the lid is finished, the work of deepening the hole is proceeded with. Digging operations are carried out at night, and in the morning little balls of earth may be seen scattered a few inches away from the nest. Frequently these balls of earth form the only indication of the presence of the nest. The accurately fitting lid, whose outside resembles the surrounding earth, renders detection almost impossible. The egg sac is round, cushion-shaped, about 11 mm. in diameter, and made of strong white silk. It is fastened to the side of the burrow about three-quarters of the way down from the opening, which is then sealed up until the young emerge from the sac.

Family ARGIOPIDÆ.

Sub-Family *ARGIOPINÆ.*

Genus *Arachnura* (Vins.)

Arachnura feredayi (L. Koch).

The female of this species is described and figured in L. Koch's classic work (F), under the name of *Epeira feredayi.* His specimens, however, came from New Zealand. At the Tasmanian Field Naturalists' Camp, 1923, the species was found by Dr. Pulleine, in the vicinity of the Tasman Memorial, on the South-East Coast of Tasmania. This is probably the first record of the spider occurring in this State, and, perhaps, in Australia, since it is not mentioned in Rainbow's census of Australian *Araneidæ* (G), although several closely allied forms are listed. There seems to be no published record of the male. This is also the case with most of the species of this genus found in other countries. Simon mentions a doubtful specimen from Ceylon (H). The minute size of the males probably accounts for their having escaped notice. The following description deals with a Tasmanian specimen of the male of *Arachnura feredayi* found near Launceston:—

Measurements in millimetres.

Total Length (abdomen contracted)	2.00
Length of Cephalothorax	0.70
Breadth of Cephalothorax (in middle) ..	0.70
Breadth of Cephalothorax (in front)	0.35
Length of Abdomen (Contracted), ...	1.65
Length of Abdomen (Expanded)	1.85
Breadth of Abdomen	1.10

Leg	Coxa	Trochanter and Femur	Patella and Tibia	Metatarsus and Tarsus	Total
1	0.20	0.55	0.57	0.60	1.92
2	0.16	0.52	0.55	0.55	1.78
3	0.11	0.35	0.35	0.40	1.21
4	0.16	0.52	0.55	0.55	1.78

Cephalothorax: As broad as long; margins well rounded; arched; narrow in front; yellowish brown in colour, with dark brown sides and a dark median stripe; clothed with a few scattered dark hairs.

Pars Cephalica: Not raised above the thoracic region; segmental groove indistinct.

Ocular Area: Broader than long; the portion on which the four median eyes stand projects over the anterior margin of the cephalic region. No fringe is present, but a few hairs are scattered over the ocular area.

Clypeus: Yellowish brown; wide; transversely wrinkled; sloping back.

Pars Thoracica: Broad; well arched; sloping sharply down under the anterior portion of the abdomen; radial grooves clear, but not deep; thoracic fovea distinct.

Eyes: The anterior median eyes are slightly larger than the posterior median eyes. The distance separating the anterior median eyes from the posterior median eyes is greater than that which separates the anterior median eyes from each other. The posterior median eyes are separated from each other by a distance equal to their own individual diameter. The lateral eyes of each side occupy a common prominence, and are separated from each other by about half their own individual diameter, and from the corresponding median eyes by about three times their own individual diameter. Front and rear laterals are about equal in size to the rear median eyes.

Legs: Yellowish brown; femur and tibia of each leg lightly clothed, tarsus and metatarsus more densely clothed with brown hairs. No spines are present on any of the legs. The tarsus ends in the usual three claws. Each of the paired claws possesses a row of four slightly curved teeth. Several terminal hairs are modified to form accessory claws.

Palpi: About 0.8 mm. long when unexpanded; thinly clothed with yellow hairs. The tarsal segment is furnished

with an accessory branch or paracymbium. The tibia is extremely short, being about equal in length to the patella. On the inner side of the femoral segment is a depression for the reception of the coxal spur. In the unexpanded bulb the slender terminal style is visible, and ends in a sharp black point. The medium apophysis with its serrated edge can also be seen. *See fig. 7.*

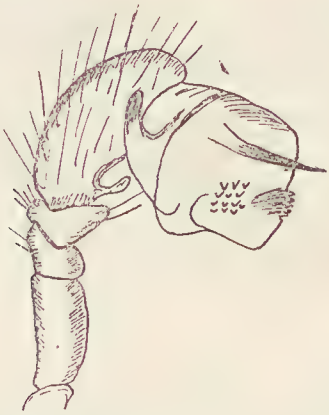

Fig. 7. *Arachnura feredayi* (L. Koch). Right palpus of male.

Falces: Yellowish brown in colour; furnished with a well-curved serrated fang. The basal segment is 0.12 mm., and the fang 0.1 mm. long. The inner angle of the furrow of each falx is armed with a row of three strong teeth, and the outer angle with one, while there are two small intermediate teeth. A few scattered dark-brown hairs are visible on the falces.

Labium: Yellowish brown, triangular, broader than long, one or two hairs at the apex.

Maxillæ: Yellowish brown, furnished with a well developed serrula. The beard is represented by a few long hairs on the inner margin. A short coxal spur is present on the outer margin.

Sternum: Yellowish brown, shield-shape, terminates in a rounded elongation between the fourth coxæ; clothed with a few dark hairs; length equals 0.55 mm.; breadth, 0.40 mm.

Abdomen: Pyriform; the anterior portion overhangs the base of the cephalothorax. The narrower terminal por-

tion is contractile, and in the contracted condition displays a number of transverse wrinkles. A few hairs are evenly spaced along the wrinkles. When the terminal portion is expanded, it forms a short tail, which ends in five blunt projections. This tail is relatively much shorter, and consequently less mobile than that of the female. The anterior margin of the abdomen is not cleft as in the female, but there is a slight projection on each side. The colour of the abdomen is light brown, with two darker areas, one on each side of a more or less rectangular region on the upper side.

Spinnerets: Brown, hairy, and surrounded by a single row of hairs. They occupy a position on the under surface of the abdomen a little more than half-way from its anterior margin in the contracted condition.

Field Notes: The males were found during the latter part of January, in the webs of the females. These webs are usually hung three or four feet from the ground, in a shady situation, near a creek. They are often found on the common gorse (*Ulex europeus*). Sometimes four or five webs are hung on the one bush. The snare consists of an irregular net-work of threads, in the centre of which is suspended at an incline an incomplete circular web 10 to 15 centimetres in diameter. This web is made up of about 20 to 29 radii, which converge to a meshed hub in the centre. Round the hub is a notched zone of three or four turns, and outside this a free space of about one centimetre. The radii, hub, and notched zone are made of non-viscid thread. Outside the free space is an incomplete viscid spiral. Three or four sectors above the hub are left open. Below the hub the spiral consists of 20 to 30 turns. To the radius which bisects the open sectors, the spider frequently attaches dry leaves, twigs, etc., and behind these takes cover when disturbed. Here also is hung the string of egg cocoons, sometimes as many as twelve in number. The web is always made so that the lowest egg cocoon is at the hub. Here the spider hangs from the under side of the web head downwards, with her tail resting on the lowest egg cocoon. These cocoons are oblong in shape, about one centimetre long, made of strong brown thread, and strung together in such a way that the lower end of one cocoon overlaps the upper end of the next, and so on. Each cocoon contains about 46 eggs, which are small, nearly spherical in shape, and of a pale yellow colour.

The males were found in the irregular net-work, which surrounds the circular snare. In several instances two males were present in the one web.

Locality: Punch Bowl Reserve, Launceston.

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(C) Rainbow, Rec. Austr. Mus., X., 8, 1914, page 239.

(D) Rainbow and Pulleine, Rec. Austr. Mus., XII., 7, 1918, page 160.

(E) Hogg, Proc. Zool. Soc., 1902, Vol. II., Part I., page 123.

(F) L. Koch, "Die Arachniden Australiens," 1871, page 122.

(G) Rainbow, Rec. Austr. Mus., IX., 2, 1911, page 179.

(H) Simon, "Histoire Naturelle des Araignées," 1895, I., page 777.

Chenistonia trevallynia ♂ (*sp. nov.*)
(enlarged).

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Chenistonia trevallynia ♀ (*sp. nov.*)
(enlarged).

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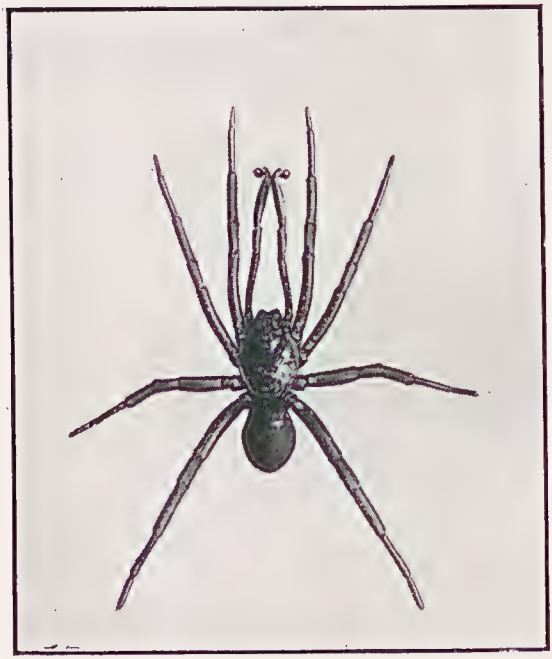

Heteromigas dovei (Hogg) ♂
(enlarged).

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Heteromigas dovei (Hogg) ♀
(enlarged).

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STUDIES IN TASMANIAN MAMMALS, LIVING AND EXTINCT.

No. XIV.

THE EARED SEALS OF TASMANIA (Part 2).

Arctocephalus tasmanicus, sp. nov.

By

H. H. Scott, Curator of the Launceston Museum,

and

Clive Lord, F.L.S., Director of the Tasmanian Museum.

Plates XVI.-XXI.

(Read 14th December, 1925.)

As pointed out in our last paper (1925, p. 75), the Eared Seals of the Australian coasts have been revised recently by Professor F. Wood-Jones, D.Sc., F.R.S. (1925, p. 9), who lists three species under the genus *Arctocephalus*, namely:—

1. *Arctocephalus cinereus*, Péron.
2. *Arctocephalus doriferus*, Wood-Jones.
3. *Arctocephalus forsteri*, Lesson.

When listing the Tasmanian vertebrates a year or so ago (Lord and Scott, 1924, p. 307) we referred to the Fur Seal of Bass Straits as *Euotaria cinerea*, but whilst referring to and accepting McCoy's data, we drew attention to the need for further research.

These further investigations we have been endeavouring to carry out, and the publication of the paper on the Eared Seals of South Australia (Wood-Jones, 1925) was of considerable assistance, as it dealt fully with the synonymy, etc., of the three above-mentioned species.

As a result of Professor Wood-Jones's visit to Tasmania he was able to see certain of our collections, and also we are indebted to him for an exchange of specimens.

Concerning *Arctocephalus cinereus*, we would point out that this is a large so-called "hair seal" ranging in size from 10 to 12 feet in length for the males, and 8 to 10 feet for the females. As the skull characters are well defined, and the size, as well as the nature of the pelts, marks them out as a specific group, they do not strictly come within the scope of our present paper.

As regards *Arctocephalus doriferus* with its eleven synonymies, we have already stated (1925, p. 78) that it does not agree with the specific characters of the common seal of our coasts, while in point of size they do not agree with the third species, *Arctocephalus forsteri.*

Having examined certain of the skulls of our Tasmanian seals since writing his paper, Professor Wood-Jones agrees with us that they do not fit in with either of the three species of his list, and he has suggested specific distinction, which we propose to give in this paper. Within the last few weeks the Tasmanian Museum was able to secure a series (adult pair and young) of this seal, and our thanks are due to the Police Department for securing the specimens, which have proved of considerable assistance, as the series contains associated skulls and pelts of both sexes as well as the young.

Before dealing with the specific characteristics, however, it may be as well to refer once more to Professor McCoy's descriptions (1879, p. 31, and 1883, p. 71) as given in the Prodromus of the Zoology of Victoria. His splendid notes detail *Euotaria cinerea,* and upon the evidence of Constable G. Ardill he regards this as the only seal found from Philip Island to Wilson's Promontory. Ardill says that the seals inhabit all the islands of Bass Straits, but he evidently knows nothing definite as to their classification. In McCoy's earlier account (1879, Dec. 4, p. 11) it was stated that the species in question had at one time been found in Bass Straits, but was then (1879) exceedingly rare.

Lucas and Le Souef (1909) re-listed *Euotaria cinerea* under the heading of "The Australian Sea Bear" (*Arctocephalus forsteri*) and reproduced McCoy's illustrations and data.

Professor Wood-Jones (1925) includes both the above names as synonymies of his recently-created species *Arctocephalus doriferus,* and, having examined skulls of our Tasmanian seals, notes that their structural departure is specific from the crania of the species described by him.

Under the circumstances we propose in the present instance to describe the specific characters of the common Tasmanian seal and to assign to it the designation *Arctocephalus tasmanicus* (the Tasmanian Fur Seal).

ARCTOCEPHALUS TASMANICUS, SP. NOV.

GENERAL DESCRIPTION.

Males.

Eight feet six inches when fully grown, a stature that is probably reached at the eighth year, although no super-ossification of the skull will have then taken place. The palatine, zygomatic, and facial sutures will be in strong evidence, and the sagittal crest will be as detailed previously (1925, p. 77) concerning the Scamander skull. The mandibular symphysis will withstand careful maceration, but if an exceptionally well-cleaned jaw is required the rami will part company.

Skin, if tanned, will form mat of the following size:—

Length, including hind feet	8 feet 6 inches
Width of skin	4 feet 3 inches
Length of arm	1 foot 9 inches
Width	1 foot 2 inches
Length of hind limb	1 foot 2 inches
Width of hind limb	6 inches

Nails of hind limb a full inch in length (for the central three), their points being three inches from the ends of the skin flaps, the two outside nails being smaller.

Colour.

Hairs of face and nose greyish, but darker upon the cranium, lighter again upon the neck, although darker than the face. All the back brown, with a hint of grey caused by the lighter tips of the longer hairs. Dark isabelline upon the chest, with light but rich chocolate upon the sides and belly, darker from the pectoral axilla downwards. The haired parts of the arms and feet very dark brown, under full chocolate colour.

In the males at maturity the front limb greatly exceeds the length of the hind limb, but in the females and young they are of even length, whiskers 8 inches long, horn colour at tips, and black at the basal ends. In very old males these whiskers become quite black, and longer and stronger than in early adult life.

Female.

The notes here given were collected from an animal that had just reared its first pup, its age being very close to 4 years, but under rather than over that amount. The total length of the skin is 5 feet 2 inches and 35 inches wide with-

out any skin trimming. The forearm is 12 inches x 4½ inches, and the hind limbs are the same size. The nails are similar to those of the male in the reduction of size consistent with the smaller bulk of the animal—being just an inch in length and 3 inches from the tips of the skin flaps. The whiskers are 7 inches long, and quite black in colour.

Pelt Colour.

The face is lighter than that of the male, and the cranium a dark silver grey, that shades to brown as it crosses the neck. The whole of the dorsal areas are brown, and in the spread skin—with its lighter edges—it might be described as a wide dorsal stripe. Chest isabelline tint, belly rich chocolate which grades by shades of yellowish brown up to the dorsal areas.

The under fur is lighter in colour than that of the male, and agrees with the young in this respect. In an animal at this stage of development, the skull will be quite devoid of a sagittal crest, all sutures will be open, in the face, zygoma, and palate, and the basi-cranial synchrondrosis unankylosed. The mandibular symphysis would not resist maceration.

YOUNG.

The animal here described is the young of the female just passed in review, and therefore the first pup of a young mother. The total length of the skin is 4 feet 5 inches and the width 26 inches. The forearm is 9½ inches long x 4½ inches wide, and the hind limb is of the same size. The nails are about ¾ of an inch long and 2 inches from the tips of the skin flaps.

Colour of Pelt.

Face a very light fawn shade, and this tint is carried on to the throat and chest. All the areas that are rich chocolate in the adults are here several shades lighter. Practically the whole back is a uniform tint of grey-tipped brown shafted hairs, that give grey or brown shades if the hand crosses the pelt. In the winter it is, of course, grey. The rich under-fur is similar to that of the female. The whiskers, which are black, are 7 inches long.

As this animal is assumed to be less than two years old, the following skull notes may be inset here. All cranial and facial sutures open, with evidence of a fronto-parietal fontenel. Mandibular symphysis not ankylosed.

CO-TYPES.

Having thus dealt with three stages, and incidentally both sexes of the seal in question, it will be necessary to now conduct an inquiry into the diagnostic skull characters of the new species, and in this work as no Holotype could be readily selected a series of ten Co-types has been created with four associated skulls, of which five are the property of the Tasmanian Museum and five belong to the Launceston Museum.

The following list gives details concerning the above-mentioned Co-types:—

Arctocephalus tasmanicus.

1. Skull and associated skin. Tasmanian Museum No. D 751. Male. Estimated age 7½ to 8 years. Collected at Councillor Rock, S.E. of Clarke Island, Bass Straits. August, 1925.

2. Skull and associated skin. Tasmanian Museum No. D 752. Female. Estimated age 3½ to 4 years. Councillor Rock, Bass Straits. August, 1925.

3. Skull and associated skin. Tasmanian Museum No. D 753. Young. Councillor Rock, Bass Straits. August, 1925.

4. Skull. Launceston Museum. Male. Estimated age 12 years. Specimen obtained from Cooee, Northern Tasmania.

5. Skull. Launceston Museum. Male. Estimated age 10½ to 11 years. Northern coast of Tasmania.

6. Skull. Tasmanian Museum No. D 737. Male. Estimated age 9½ to 10 years. Two Mile Beach, North Bay, South-Eastern Tasmania.

7. Skull and associated skin. Launceston Museum. Male. Estimated age 8-9 years. Collected at Scamander.

8. Skull. Launceston Museum. Male. Estimated age 5 years. Northern Tasmania (Barren Joey?).

9. Skull. Tasmanian Museum No. D 746. Female. Estimated age 8 years. Bicheno, East Coast, Tasmania.

10. Skull. Launceston Museum. Female. Tamar Heads, Tasmania.

SKULL.

The sagittal crest characters have already been given in our former paper, so we will here begin with the teeth. The dental formula is as follows:—

$$\text{Incisors } \frac{3 \cdot 3}{3 \cdot 3} \quad \text{Canines } \frac{1 \cdot 1}{1 \cdot 1} \quad \text{Molars } \frac{6 \cdot 6}{5 \cdot 5}$$

All the molar teeth with anterior and posterior cusps (the two important departures from *Euotaria cinerea* of McCoy being the extra pair of mandibular incisors, and the retention of cusps throughout the molar series). The first four teeth of the cheek series, in both males and females, are larger than the fifth and sixth pairs, but in the young skull the second pair are the largest of the series. An interesting variation in the immature skull is to be found in the fact that the large lateral incisors are developed in excess of the true canines, exceeding them in length by 5 mm. In the mandible of the male, the first pair of molars are smaller than the remaining four pairs, the latter being almost even in size. In the female mandible the disproportion between the first molars and the remainder of the series is much less marked, and even less so again in the immature animal.

To assist the busy man in separating skulls of *A. cinereus* of Wood-Jones and the animal described by McCoy and listed as *Euotaria cinerea*, Péron, but now reduced to a synonym of *A. doriferus* by Professor Wood-Jones, we supply the following diagnostic characters.

OUTLINE DETERMINATIVE CHARACTERS.

The skulls of *Arctocephalus tasmanicus* are all furnished with strong, post-orbital molar processes, *even in the very young animals*, and if the skull is turned base upwards, these molar processes will be found curving well into the zygomatic area. These *do not obtain* in the Victorian animal, but are very slightly in evidence in *Arctocephalus cinereus*. McCoy gives the molar tooth line at 58 mm. for a male animal in *A. tasmanicum* (this would vary from 65 mm. to 72 mm. with age and individual developments), and well up to 80 mm. for the molar series of the South Australian seal, *Arctocephalus cinereus*. The nasal bones supply another test, as the following data will show:—

Arctocephalus cinereus—Maxillary moieties pass the posterior ends of the nasals.

Arctocephalus tasmanicus—The nasals pass the maxillary moieties and expand behind them in matured males and females, but only just pass them in young animals.

Arctocephalus doriferus—Nasals nearly reach the maxillary moieties (Wood-Jones).

If the skulls of the above and those of *Arctocephalus forsteri* of New Zealand (and possibly our waters also) be placed upon the measuring table we get as a result these figures:—

Arctocephalus cinereus, condylo-basal length 290 mm. to 300 mm.

Arctocephalus tasmanicus, condylo-basal length 280 mm. to 290 mm.

Arctocephalus doriferus, condylo-basal length 250 mm.

Arctocephalus forsteri, condylo-basal length 230 mm.

The above are for male skulls and of the species *doriferus*. Professor Wood-Jones gives similar sizes for male and female skulls, but this does not obtain in our Tasmanian species, in which the female skulls seldom exceed a condylo-basal length of 240 mm.

The quickest way to separate skulls of *A. tasmanicus* from those of *A. cinereus*, if the anterior parts are mutilated, is to take the supra-orbital processes of the frontals as a guide, as these in *A. cinereus* are nearly 90 mm. across—as against an absolute maximum of 75 mm. in old and heavily ossified skulls of *A. tasmanicus*. In the female skull of our species these processes reach a maximum—in old skulls—of 50 mm. Although we have collected a much larger body of osteological data than that just presented, we cannot at the moment extend the limits of the present paper, but may return to the subject at a future date.

Of the thirty-six synonyms listed by Professor Wood-Jones for the three species of his determination, it is more than likely that some should be accredited to the seal we have just named *Arctocephalus tasmanicus*, but as our aims are practical we can find no accurate description of the animal we are dealing with, and it certainly falls outside the determinations last presented to Australian science, we have decided upon the designation submitted in the present text—namely, *Arctocephalus tasmanicus;* vernacular name, the Tasmanian Fur Seal.

We desire to draw attention to the economic value of the species, as we are convinced that if taken at the proper time

of year and correct stage of growth the pelts would be of considerable value. The economic aspect is well worthy of attention by the Tasmanian authorities concerned, particularly so in view of the attention at present being given to the fur seals by the countries bordering on the Pacific.

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1909 Lucas and Le Souef, Animals of Australia.
1924 Lord and Scott, The Vertebrate Animals of Tasmania.
1925 Wood-Jones, Records S. Aust. Mus., Vol. 3, No. 1.
1925 Scott and Lord, Pap. & Proc. Roy. Soc. Tas., p. 75.

EXPLANATION OF PLATES.

Arctocephalus tasmanicus (sp. nov.)

Plate XVI. Co-type 1. Male skull to show teeth. Estimated age 7½ to 8 years. Tasmanian Museum No. D 751. Collected at Councillor Rock, South-east side of Clarke Island, Bass Straits, and about 35 miles from Tasmanian coast.

Plate XVII. Co-type 2. Female skull to show teeth. Estimated age 3½ to 4 years. Tasmanian Museum No. D 752. Collected at Councillor Rock, Bass Straits.

Plate XVIII. Co-type 4. Old male skull showing large malar post-orbital processes. Estimated age 12 years.

Plate XIX. Co-type 4. Basal view of old male skull.

Plate XX. Co-type 9. Female skull showing super-ossification. Estimated age 8 years.

Plate XXI. Co-type 9. Basal view.

ADDENDUM.

Since writing the above, we have received a copy of Mr. A. S. Le Souef's paper (Aust. Zoologist, Vol. 4, p. 112) which was published on the 10th November last. We fully agree with Mr. Le Souef as regards the economic value of our seals, and there is also the evidence of fishermen and others that there are more than one species of fur seal in Bass Straits.

Arctocephalus forsteri may occur in the Straits, but so far we have not secured specimens, and the common seal of Tasmanian waters is the animal which we have designated *Arctocephalus tasmanicus*.

Arctocephalus tasmanicus (♂).

(Co-type 1.)

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Arctocephalus tasmanicus (♀).

(Co-type 2.)

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Arctocephalus tasmanicus (♂).

(Co-type 4.)

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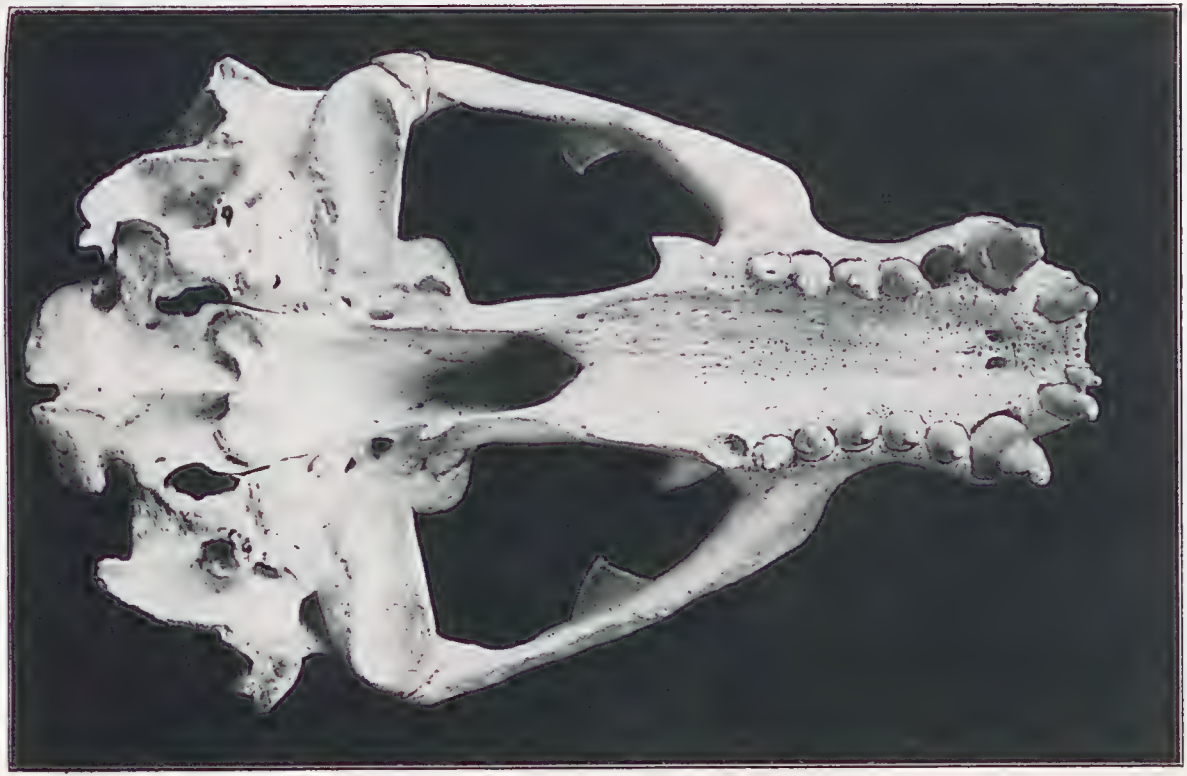

Arctocephalus tasmanicus (♂).

(Co-type 4.)

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Arctocephalus tasmanicus (♀).

(Co-type 9.)

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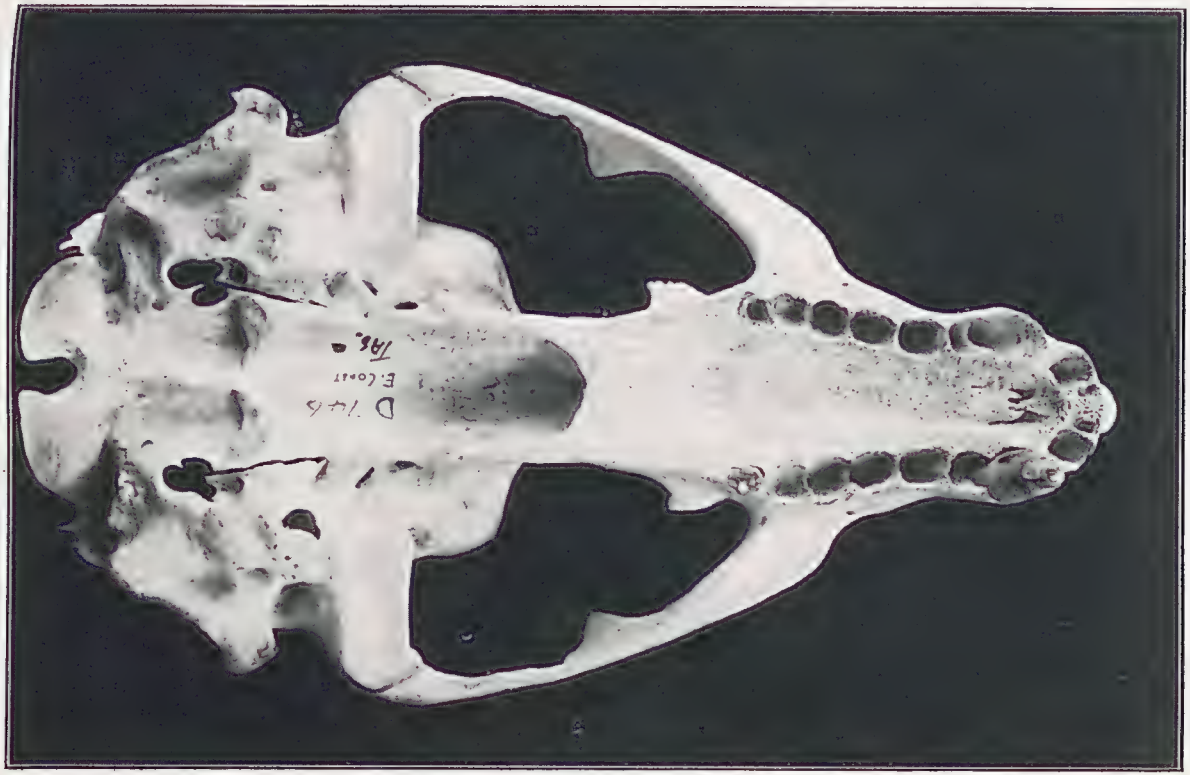

Arctocephalus tasmanicus (♀).

(Co-type 9.)

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TASMAN'S LANDING PLACE.

By

G. H. Halligan, L.S., F.G.S.,

Late Hydrographer and Supervising Engineer, N. S. Wales Government.

With One Text Figure.

(Read 14th December, 1925.)

According to his Journal, Abel Janszoon Tasman planted his flag and took formal possession of the land, now called Tasmania, on the 3rd of December, 1642.

Unfortunately, the exact position of his anchorage was not fixed by bearings to, or angles between the various headlands, islands, or prominent features in the vicinity, but in other respects the journal is so complete and is so clearly written that the historic spot at which the flag was planted can, I think, be located within a few yards. The matter has already been investigated, mainly through the indefatigable exertions of Mr. Moore-Robinson, Mr. John Kennedy, and Captain Bowerman, who decided that the great navigator had landed at the head of Prince of Wales Bay, an indentation immediately adjoining Cape Lamanon, on Forestier's Peninsula. A very substantial and appropriate monument has been erected at the site chosen, on which the following inscription appears:—

At this spot the expedition under
Abel Jansz Tasman,
being the first white people
to set foot on Tasmanian soil,
planted the Dutch flag
on December 3rd, 1642.

As a memorial to posterity and to the inhabitants of this country
this stone was erected by the Royal Society of Tasmania,
1923.

Some doubts, however, arose amongst certain members of this Society, and a discussion of the matter took place at the rooms on the 17th December, 1923 (see Papers and Proceedings, 1923, p. 166). It was then decided that, in view of the indefinite nature of the evidence, the words of the inscription "At this spot" should be altered to "Near this spot."

During the discussion I expressed the opinion that the landing took place near the south-east corner of North Bay, about 2 miles south-east of the monument, but as I had not visited the site and there might possibly be local objections, such as unfavourable land configuration or the existence of shoal water or foul bottom at the position of anchorage, I have refrained from writing on the subject until I could find time to further investigate.

Owing mainly to my absence from Tasmania, I have only lately been able to examine the locality in detail, and now desire to place before the Members of this Society the result of my inquiry.

To enable us to follow Tasman's movements, I here reproduce copies of his journal of the 1st, 2nd, and 3rd of December, 1642, as edited by J. E. Heeres. The translation has been carefully compared with the original in the Mitchell Library, Sydney.

EXTRACTS FROM TASMAN'S JOURNAL.

Ed. by J. E. Heeres.

1st December, 1642.

"At noon lat. observed 43 deg. 10 min., long. 167 deg. 55 min.; course kept N.N.W., sailed 8 miles (32 Eng. miles), it having fallen a calm; in the afternoon we hoisted the white flag, upon which our friends of the *Zeehaen* came on board of us, with whom we resolved that it would be best and most expedient, wind and weather permitting, to touch at the land the sooner the better; both to get better acquainted with its condition, and to attempt to procure refreshments for our own behalf; all of which may be more amply seen from this day's resolution. We then got a breeze from the eastward and made for the coast to ascertain whether it would afford a fitting anchorage; about 1 hour after sunset we dropped anchor in a good harbour in 22 fathoms (21.65 English fathoms), white and grey fine sand, a naturally drying bottom; for all which it behooves us to thank God Almighty with grateful hearts.

2nd December, 1642.

"Early in the morning we sent out Pilot-Major Jacobsz . . . . , to a bay situated N.W. of us, at upwards of a mile distance (4 Eng. miles), in order to ascertain what facilities (as regards fresh water, refreshments, timber and the like may be available there). About three hours before nightfall the boats came back. . . . . This day we had variable winds from the eastward, but for the greater part of the day a stiff steady breeze from the S.E.

3rd December, 1642.

"We went to the S.E. side of this bay in the same boats as yesterday . . . . . ; here we found water, it is true, but the land is so low lying that the fresh water was made salt and brackish by the surf, while the soil is too rocky to allow of wells being dug; we therefore returned on board and convened the councils of our two ships, with which we have resolved and determined what is set forth *in extenso* in to-day's resolution, to which for briefness sake we refer.

"In the afternoon we went to the S.E. side of this bay in the boats aforesaid, having with us Pilot-Major Francoys Jacobsz, Skipper Gerrit Jansz, Isack Gilsemans, supercargo on board the *Zeehaen*, sub-cargo Abraham Coomans, and our master carpenter, Pieter Jacobsz; we carried with us a pole with the Company's mark carved into it, and a Prince-flag, to be set up there, that those who shall come after us may become aware that we have been here, and have taken possession of the said land as our lawful property. When we had moved about half-way with our boats it began to blow very stiffly, and the sea ran so high that the cock-boat of the *Zechaen*, in which were seated the Pilot-Major and Mr. Gilsemans, was compelled to pull back to the ships, while we ran on with our pinnace. When we had come close inshore in a small inlet which bore W.S.W. of the ships, the surf ran so high that we could not get near the shore without running the risk of having our pinnace dashed to pieces. We then ordered the carpenter aforesaid to swim to the shore alone, with the pole and flag, and kept by the wind with our pinnace; we made him plant the said pole with the flag at top into the earth at the centre of the bay near four tall trees, easily recognisable, and standing in the form of a crescent, exactly before the one standing lowest . . . . the carpenter aforesaid therefore swam back to the pinnace though the surf . . . . During the whole of the day the wind blew chiefly from the north; in the evening we took the sun's azimuth and found 3 deg. N.E. variation of the compass; at sunset we got a strong gale from the north, which by and by rose to so violent a storm from the N.N.W. that we were compelled to get both our yards in and drop our small bower anchor."

Although not of importance to our present purpose, it is to be regretted that the "day's resolutions" referred to in this journal, which correspond to Minutes of Meetings or conferences held with the Master of the *Zechaen*, cannot be found.

Tasman was a very wonderful navigator, and was a very observant and careful man, and before all else he was a sailor, and if his journal should appear vague at any particular

point, we must interpet it with this knowledge. He records having dropped anchor, in a good harbour, about an hour after sunset on the 1st of December, 1642. His noon observations show the ship to have been off Cape Frederick Hendrick, and the weather to be calm, but in the afternoon they got a breeze from the eastward, which enabled him to make the anchorage he desired, and for which he was so thankful. If we remember that it was getting on towards nightfall, he was on a totally unknown coast, and he was under sail only and was making for a lee shore, we will naturally conclude that his sailorly instinct would not allow him to go further into North Bay than would ensure safe anchorage. He would be perfectly safe if anchored in the position shown on the chart (see Text Figure), and would have been able to beat out if the wind had suddenly shifted northwardly, as he had every reason to expect. Had he gone further west he would have been embayed, or in a position no sailor would willingly get.

The law of storms was not very well understood in Tasman's day, but it was well known to mariners that the wind in the southern hemisphere always veers from south to north through east, so that Tasman would be on the look-out for easterly, north-easterly, and then northerly winds, which would be one very strong reason for his choosing an anchorage from which he could get away as soon as possible.

On the 2nd of December Tasman sent his Pilot-Major "to a bay situated north-west of us, at upwards of a mile "distance (4 English miles)" to spy out the land, and we find on referring to the Lands Department plan, that the distance from the supposed anchorage to the entrance to Blackman's Bay is just on 4 miles, in a north-westerly direction. It will also be noted that had Tasman been anchored off Prince of Wales Bay, as supposed by Mr. Moore-Robinson, there would be no bay 4 miles to the north-west of him.

On the 2nd of December Tasman records: "This day we "had variable winds from the eastward, but for the greater "part of the day a stiff steady breeze from the south-east."

We now come to the eventful day of the landing, and the journal states:—"We went to the south-east side of this "bay in the same boats as yesterday. . . . . Here we found "water, it is true, but the *land is so low lying* that the fresh "water was made salt and brackish by the surf, while the soil "is too rocky to allow of wells being dug."

At the south-east corner of North Bay the present-day chart shows a creek connecting with a small lagoon about 250 yards from the sandy beach. The water in this creek and in the lagoon is brackish, and the soil on the eastern side is rough and stony, exactly as described in the journal.

TASMANIA
FORESTIERS PENINSULA
SHEWING TASMAN'S LANDING PLACE
ON 3RD DECEMBER 1642
CAPE PAUL LAMANON
PRINCE OF WALES BAY
CAPE FREDERICK HENDRICK
NORTH BAY
WILMOT HARBOUR
BLACKMANS BAY
DUNALLEY
YELLOW BLUFF

The journal continues: "In the afternoon we went to the "south-east side of this bay in the boats aforesaid," and then goes on to describe how one boat had to turn back on account of the rough sea, but the pinnace went on. To quote further from the journal: "When we had come close inshore in a "small inlet which bore west-south-west from the ships, the "surf ran so high that we could not get near the shore without "running the risk of having the pinnace dashed to pieces." This is the small inlet, or creek entrance, before referred to, which bears west-south-west from the assumed anchorage, and as the wind during the day blew chiefly from the north, the locality would be the best that could be chosen by a sailor under the circumstances. It is difficult to understand why Tasman delayed the planting of the flag to the afternoon when the ceremony could have been carried out when he landed at the same spot in the morning to search for water, but the possible explanation is, that the pole "with the Com- "pany's mark carved into it" was not ready. It had, of course, to be prepared and rigged from spare spars carried on board.

As would, I think, naturally be expected, there are no signs of the four large trees referred to in Tasman's journal. These have long ago, by the effects of bush fires and natural decay, been reduced to dust and ashes, and nothing tangible remains to mark the notable spot where the illustrious navigator landed.

On the occasion of my visit to the locality a hard south-west gale was blowing, with blinding rain, so that it was impossible to get to the assumed anchorage in a boat to take soundings. It will be interesting to know if the depth of 22 fathoms (21.62 English fathoms) still exists at the anchorage shown. The exact figures are not, of course, important, as the bottom is "white and grey fine sand," and the depth liable to vary a fathom or two, according to the weather.

Quite apart from the extracts from Tasman's journal and the deductions here given, I have made some calculations to ascertain the time and height of the tide on the date of the landing, with the object of confirming or invalidating the results arrived at.

In order to make these matters quite clear to those members who have not studied the subject very closely, it will be necessary to state, in as few words as possible, some of the elementary facts of the science of chronology.

The Egyptians knew that a year contained between 365 and 366 days, but the Romans did not profit by this information, for Romulus made a year consist of 304 days; this was altered by Numa to one of 355 days—extra months being occasionally intercalated, so that the seasons might recur at

about the same period of the year. This naturally resulted in much confusion in calculating intervals of time, and in 45 B.C. Julius Cæsar decreed that thenceforth the year should contain 365 days, except that in every fourth or leap year one additional day should be introduced. He ordered this rule to come into force on 1st January, 45 B.C.

The Julian Calendar made the year (on the average) contain 365.25 days. The actual value is 365.2422419 days. Hence the Julian year is too long by about 11¼ minutes, and this produces an error of nearly one day in 128 years. This error gradually accumulated, until in the sixteenth century the seasons arrived some ten days earlier than they should have done. In 1582 Pope Gregory XIII. corrected this by omitting ten days from that year (which therefore contained only 355 days), and decreeing that henceforth every year which was a multiple of a century should be or not be a leap year, according as the multiple was or was not divisible by four. The work of framing the new Calendar was entrusted to Clavius, who believed the year to contain 365.2425432 days, but omitted the last three decimals in his assumption of the average length of the year. As we now know the actual value to be 365.2422419 days, there is still an error of one day in about 3,600 years in the Gregorian Calendar.

The change was adopted immediately in all Catholic countries, but more slowly in Protestant. In Scotland the change was made in 1600. In the German Lutheran States it was made in 1700. In England a bill to carry out the reform was introduced in 1584, but was withdrawn after being read a second time; and the change was not effected finally until the 2nd September, 1752, eleven nominal days being then struck out, so that the last day of the "Old Style" being the 2nd, the first day of the "New Style" (the next day) was called the 14th instead of the 3rd. By this it will be seen that the year 1752, in England, contained only 355 days instead of 366 days, it being a leap year. Now a knowledge of this fact is necessary when calculating the time of high water on the East Coast of Tasmania on the 3rd of December, 1642, the date of Tasman's landing.

We know that, at intervals of 18 years and 11 days, the moon returns to the same relative position with regard to the earth, and full and new moon fall on the same day of the month. On the 14th May, 1913, the moon would have been in the same relative position with regard to the earth as it was on the 3rd December, 1642, assuming that no variation in the length of any intermediate year had been made in the interval. There had, however, been a change when the Dutch Government adopted the Gregorian Calendar in the year 1700, when 11 days were taken out of that year to allow for the

accumulated error due to the Julian year being too long by about 11¼ minutes. It was therefore high water at North Bay on the 3rd December, 1642, at the same time as it was on Saturday, the 3rd May, 1913.

From the nautical Almanac we learn that the moon was new on the latter date, and it was therefore high water at North Bay at 8 hours, and low water at about 2 hours 50 minutes, or, say, 10 minutes to 3 in the afternoon of the 3rd December, 1642.

As the moon was in Apogee on the 29th November, was on the Equator on the 2nd December, and the movement of the wind from the 29th November to the 4th December, 1642, indicated a barometer a very little above normal, the tide on the afternoon of the day of Tasman's landing probably fell to within six inches of low water springs level. Under these circumstances it would be very risky, if not impossible, to have crossed the reef at the entrance to Prince of Wales Bay in a pinnace drawing at least twelve inches of water in a strong northerly breeze, and even if the crossing of the reef had been successfully accomplished, the water inside would have been comparatively smooth, and there would have been no necessity for the carpenter to swim ashore to plant the flag.

In any case, it is almost certain that some reference to the reef would have been made in Tasman's journal if it had to be crossed in order to effect a landing.

On the other hand, the journal distinctly states that Tasman went to the south-east side of the bay in which he was anchored, and the carpenter swam ashore and planted the flag near a small inlet which bore west-south-west of the ship. There is no other place except that shown on the accompanying chart, which corresponds to that very lucid and concise description, and the landing could have been effected there as well at one state of the tide as another.

It might also be interesting to state that the 3rd of December, 1642, was a Saturday.

[Note.—For other articles concerning Tasman's landing place, see—

Gell, the Tasmanian Journal, Vol. II., p. 321 (1845).
Walker, Pap. and Proc. Roy. Soc. Tas., 1890, pp. 269-284.
Mault, Report Aust. Assocn. Ad. Sc., 1892, pp. 408-412.
Moore-Robinson, *The Mercury* (Hobart), 22nd January, 1923.
Discussion and Report, Pap. and Proc. Roy. Soc. Tas., 1923, pp. 166 and 180.
Lord, Report Easter Camp Tasmanian Field Naturalists' Club, 1923. Editor.]

AUSTRALIAN FAUNA AND MEDICAL SCIENCE.

By

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Director National Museum of Australian Zoology.

(Read 14th December, 1925.)

Up till recent times the appeal for the preservation of the unique fauna of our country has been based largely on sentiment. To-day, thanks to poison and the gun, we recognise that many of our animals that were common twenty years ago are becoming increasingly rare, and within a short period of time will have completely disappeared, never to be recalled. In this paper I wish to draw attention to what is now the most urgent plea for the preservation of our fauna, viz., its importance for a correct understanding of the human body in health and disease.

The animals of Australia and Tasmania are teeming with points of scientific interest. Through them human complexities are revealed in their simpler form. Their study is really a study of human embryology, i.e., embryos in which we can study not only structure, but function, on which structure depends—for to the medical scientist the latter must be regarded as the register of the former. So-called "sports," "monsters," and "precocious developments" must have a functional origin and correlations.

NORMAL OR STANDARD TISSUE.

In the consideration of any diseased tissue of the human body, such as cancer, a comparison must be made with the condition in health—the abnormal must be compared with the normal. Thus arises the question, what is normal mammalian tissue? Recognising the effects, over centuries, of alcohol, syphilis, and other poisons on the human race, one would be loth to regard tissues from an individual dying from misadventure or natural causes as typically mammalian, and similarly with animals commonly used for experimentation, such as dogs, rabbits, and guinea-pigs, owing to the modifications of domestication. It is to the primitive mammals of

Australia and Tasmania, unaffected by syphilis, alcohol, or domestication, that have lived in a natural environment for millions of years, that we must look for normal tissue. In the case, e.g., of the ductless glands, the platypus (*Ornithorhynchus anatinus*) offers a remarkable standard for human comparison. Thus the parathyroids are constant, and easily found at the junction of larynx and trachea; Cowper's glands, rarely seen by the medical student, are highly developed; the thymus is retained in the adult; and three ductless glands not so far discovered in us can be demonstrated, viz., parathymus, scapular, and sex glands. In the National Museum the collection of normal histological preparations from reptiles and primitive mammals of Australia and Tasmania, with which human or other mammalian tissue can be compared, is quite unique in the world, and numbers many thousands.

THE HUMAN BRAIN.

To the student of medicine no portion of human anatomy presents such difficulties, whether from the point of view of structure or function, as the brain, and, for the reason that, generally speaking, he knows little about the history of the entities which go to make up the complex central nervous system. When and why does the callosum, the great connecting commissure between the hemispheres, arise? What does the fornix represent? Why is the grey matter external to the white matter? Why should the thalamus be a single body in mammals up to man, in whom the only representation of unification may be but a simple band? What does the free edge in the interior of the brain represent? Is the lateral ventricle of man a similar structure to that of reptiles? These are basic problems in neurology, and can only be answered by a study of the brains of Australian reptiles, monotremes, and marsupials. Our lizards, broadly speaking, can be divided into two main divisions, viz., those moving on their belly wall, such as the blue-tongued variety, using their limbs for bodily propulsion, but not for bodily support; and those, such as the bearded and frilled, that raise themselves off the ground, using their limbs for bodily support as well as bodily propulsion. In the former the olfactory sense is well developed in contrast to the latter with its more extended horizon, the result of an improved muscular effort towards the erect posture. Of the two monotremes, one, the platypus, depends on the streams for its food; while the echidna (*Tachyglossus*) has left the water, is found all over the Commonwealth, and has its body well raised off the

ground, using its limbs definitely for bodily support as well as propulsion. In the former the brain is smooth and unconvoluted, in contrast to the richly convoluted brain of the latter, which reminds one of a miniature human brain. Amongst the marsupials the nearest approach to the brain of higher mammals is found in the kangaroo (*Macropus*), an animal able to adopt an erect attitude owing to the tripod formed by the great tail and the two feet. Its cortex is in marked contrast to the feeble unconvoluted cortex of koala—an arboreal animal. In our mammals the free edge in the interior of the brain—which is not found in that of reptiles—is present, and the grey matter is external to the white; but the characteristic callosum of higher mammals has not yet appeared.

THE GASTRO-INTESTINAL TRACT.

Many arbitrary divisions of the human intestinal tract are described, and, in the case of the large intestine or colon, no less than nine portions are noted. In addition there are two ill-understood areas, viz., the great omentum and the lesser peritoneal sac. It may be stated that no portion of the human abdomen is so puzzling to the anatomical student as these areas. If we examine the lowly stump-tailed lizard (*Trachysaurus rugosus*) or the blue-tongued skink (*Tiliqua scincoides*) we find a simple primitive intestine without development of cæcum, great omentum, or lesser sac. In the bearded lizard (*Amphibolurus barbatus*), using its limbs for propulsion as well as support, although there is a commencement of the hitching up of intestine which reaches its culmination in erect man, together with the genesis of a cæcum and duodenum, there is still no trace of great omentum or lesser sac.

In these reptiles the heart is not yet four-chambered—there is no respiratory piston or diaphragm, and the spleen is miniature in size.

In the platypus the heart is four-chambered, the red blood cell is now non-nucleated, a diaphragm has developed, and the spleen has reached great proportions, spreading itself in the shape of two great processes over the abdominal cavity. This development of spleen has necessitated the development of a mesentery or great omentum on which it is swung, and here in its simplest form we have the development of the lesser peritoneal sac. In our monotremes and marsupials the student can study the method of gut fixation which is such a marked and puzzling feature of the human intestine, and

by studying the intestine of koala (*Phascolarctus cinereus*) or the common phalanger (*Trichosurus vulpecula*) he realises that the nine divisions of the human intestine really consist of but two portions, a right or mesenteric portion swung on the mesentery with the small intestine, and a left or mesocolic swung on the mesocolon.

In the bearded lizard we see the genesis of the cæcum, in the koala its greatest development, and in the wombat (*Phascolomys mitchelli*) we have an appendix resembling the human, but showing usually a more advanced stage of retrogression even up to complete disappearance. It may be mentioned that the minute stomach of platypus and the larger one of echidna show a lining of stratified epithelium, and not of columnar cells. In both the Tasmanian devil (*Sarcophilus*) and the Tasmanian tiger (*Thylacinus*) the intestinal tract presents a simple loop with little apparent distinction between the large and small intestines. No cæcum is present at the junction of these; but a well-defined vagal nerve distribution can be demonstrated. This latter is important in the consideration of the "lock" system of the alimentary canal, to defects of which diseases such as chronic constipation may be due.

THE MUSCULAR SYSTEM.

Of all mammals man is the most intelligent and the most erect.

Other animals, such as the anthropoid ape, monkey, and dog, can assume the erect attitude; but in all these, balance on the two limbs is an effort. There is not that freedom of the fore limbs from support that has given rise to the development of the tactual sense characteristic of the human. Whether viewed from the question of health or disease a correct understanding of the mechanism of the erect posture and its correlations, such as respiratory, circulatory, and intestinal, is essential.

The erect posture is the underlying basis of higher mammalian development, and the great epochs in this development are represented by improvements in muscular function. The erect posture is not an old acquisition, and consequently is easily attacked. To-day, recognising this, medical men are paying more attention to postural defects as the underlying pathological basis of much of the chronic disease seen in our hospitals. Included in our fauna we have animals crawling on their belly wall using their limbs for bodily progression,

not for bodily support; others, such as the platypus, using limbs for bodily support as well as progression. In the echidna we have an animal whose belly wall is definitely off the ground. In koala we find an animal able to raise its hand above its head in reaching for the gum leaf, and in the kangaroo we can study an erect posture achieved by means of a tripod.

Through our fauna also the comparative value of the functions of human muscles can be studied, and it is along these lines that the modern treatment of infantile paralysis has been evolved. We recognise that muscular functions recently acquired as seen, e.g., in connection with the ecto-gluteus of the hip or the quadriceps extensor of the knee, or those disappearing as seen, e.g., in connection with the inverters and everters of the foot, are unstable and readily attacked by disease.

THE GENERATIVE SYSTEM.

Amongst our animals are egg-layers, egg-layers provided with mammary tissue for the nourishment of the young, and others whose young are born in an immature or embryonic state and develop to maturity within a marsupium or pouch. The fact that our marsupials have solved the question of sustained life with embryonic birth is interesting, when we consider that even a seven months' human fœtus is reared with difficulty. The greatest problem in human midwifery to-day is a knowledge of the impetus causing birth. Why should a human fœtus be born after a period of development of nine months, and that of the kangaroo at one month?

By a study of the method of unification of the Mullerian ducts in our marsupials light is thrown on abnormalities met with in the human genital system. Here, too, can be studied the physiological principles of uterine suspension, to correct defaults in which so many gynecological operations are now undertaken.

In the adult male monotreme the testes are still intra-abdominal, and the urinary and genital tracts separate. In the marsupials the prostate gland appears—in fact, in animals such as the phalanger it would appear to have reached its greatest relative development. Here, too, the urethra is genito-urinary and the testes have left the abdomen and are extra-abdominal. Interesting light is thrown on the pathology of hernia (rupture). In the kangaroo, wombat, and koala the internal abdominal ring and sac are patent;

but no instance of hernia has ever been recorded in these animals. In the Tasmanian tiger and devil the internal ring is closed. Nature has "cured" the hernial sac. Why is this necessary in the latter, and not in the former?

CONCLUSION.

This article but touches human problems on which a study of the members of our fauna throws light. The foundation of the National Museum of Australian Zoology by the Federal Government is a recognition of the importance of our native animals to medical science, and of the duty owed to future generations of Australians. But time is a factor; for the fauna is fast disappearing, and every specimen is of importance.

The Federal Capital Commission has now allotted sites for the National Museum at Canberra. That for the museum, laboratories, and lecture theatre is a magnificent one on Acton Hill, not far from Civic Place, and facing Parliament House and the Capitol site. The area is a semicircular one containing five and a half acres. The Research Reservation is a peninsula of about 80 acres, bounded by the River Molonglo, and facing Black Mountain. It lies in what is known as the Continental Arboretum. Here will be kept live specimens of Australian and Tasmanian native animals in their natural state. When the buildings are erected Canberra will become the world's centre for the study of our unique fauna, and every facility will be offered to workers not only Australian, but also from abroad, wishing to study comparative anatomy and its application to modern medical and surgical practice.

Documents, illustrations, and specimens, if sent to the National Museum of Australian Zoology, which is temporarily housed at 612 St. Kilda Road, Melbourne, will be catalogued with the donor's name attached, and will be national property for all time.

NOTES ON THE CURRENCY OF EARLY TASMANIA (1803-25).

By

JOHN REYNOLDS.

Plates XXII. and XXIII.

(Read 14th December, 1925).

SYNOPSIS.

A. Introduction—
- (a) Introductory Notes.
- (b) The currency of early New South Wales (1788-1803).
- (c) The settlement of Tasmania.

B. The Tasmanian Currency (1803-25)—
- (a) Coinage.
  - (i) Scarcity of the early years.
  - (ii) The Colonial coinage (1813).
  - (iii) Brisbane's reforms.
  - (iv) The McIntosh-Degraves tokens.
- (b) Paper Money.
  - (i) Official issues.
  - (ii) Private issues.
- (c) Primitive methods of exchange.
  - (i) Barter of goods.
  - (ii) The Rum currency.

C. Acknowledgments.

D. Bibliography.

A. INTRODUCTION.

(a) INTRODUCTORY REMARKS.

The economic history of Tasmania has yet to be written. This paper is offered as an introduction to that section of the subject which embraces the currency and the exchange relations of the early colonists. The period covers the years of governmental dependence of Tasmania upon New South Wales. These years stand out distinctly when we

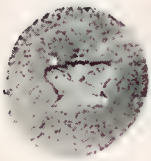
survey the growth of the State. Two reasons sufficiently account for this fact. Firstly, the young Colony was ultimately ruled by the Governors of New South Wales, who, with one exception, were little acquainted with the island's affairs. Secondly, the local Lieut.-Governors were responsible only to their superiors at Sydney, often a fortnight's sail away. Until the closing years of the period, any form of constitutional government was impracticable, and the Lieut.-Governors exercised their wide powers unchecked. Owing to the nature of the Tasmanian settlements the Government entered very largely into the life of the community. As well as exercising all those functions with which we are to-day familiar, it was the chief purchaser of the products of the soil, it sold settlers' requirements, and it regulated conditions of labour at its pleasure. After 1825 this state of affairs rapidly changed as a result of separation from New South Wales, the beginnings of responsible government, and the great influx of free settlers from Great Britain. Owing to the Colony's intimate connection with New South Wales, it is from the history of that State we must seek to gain a clear understanding of many aspects of life in early Tasmania. This is most necessary in the case of the currency.

Our knowledge of the first decade of this State's existence is unfortunately very limited; apart from official documents and a few private papers of early settlers, we have no sources of information. The diary of that worldly chaplain, the Rev. Robert Knopwood, provides a certain amount of interesting information, but it is of little assistance for the present study. More records have come down to us from the later years of the period. The *Hobart Town Gazette*, a newspaper under official control, provides us with a useful quarry of facts. The official papers are greater in numbers, and become more informative. The House of Commons, in 1821, sent out a commissioner in the person of J. T. Bigge, to inquire into all branches of administration of the colonies. His inquiries were searching, and his report is invaluable to the student of the times. But the greatest want felt is the private papers and letters of colonists to give us a peep behind the scenes, and enable us to understand what they thought of all the gubernatorial wisdom. No doubt a future generation, by the discovery of some papers now hidden, will be better informed than we are to-day.

(b) The Currency of Early New South Wales (1788-1803).

From the earliest days there was at Sydney a lack of

SPANISH DOLLAR.



Obverse.

Reverse.

DUMP DOLLAR.

HOLEY DOLLAR.

NATIONAL MUSEUM MELBOURNE

British coin, or any other reliable metallic money. The Home Authorities had only sent out a few chests of coin with the First Fleet. This amount they considered ample for a small penal settlement. As early as June, 1789, Phillip found himself unable to pay wages in coin. His request for another remittance of specie was not complied with for over two years. Late in 1792, £2,500 of British silver arrived at Sydney. Nearly ten years were to elapse before another supply of coin was despatched to the Colony. The reason is not hard to find. The British nation was fighting abroad in a death struggle with Revolutionary France. At home, famine and dissatisfaction walked hand in hand. In 1797 the Bank of England suspended gold payments. It is not difficult to understand the unwillingness of Ministers to send coin to a small penal settlement on the Pacific coast of an almost unknown continent.

[Phillip to Nepean, 20/6/1789, 1 (a).]

In New South Wales, matters went from bad to worse. With no export trade there was a continual drain on the scanty supply of coin to pay for imports. The ships which made purchases of supplies left behind them a great assortment of coins, the currencies of many nationalities being represented. The shortage of coin and general conditions produced a state of affairs that had been experienced in the American colonies, particularly Massachusetts, a century before. The official receipts given by the Government Stores for produce passed immediately into circulation. They were really official promissory notes. Private promissory notes were also issued in great numbers, and became a menace to credit. Spirits bearing the general designation of rum entered into colonial life to an almost incredible degree; a gallon of rum became an accepted value, which even the authorities were forced to recognise.

In 1800, Philip Gidley King became Governor of New South Wales. Despite difficulties arising from the insubordination of the New South Wales Corps, his only military force, and an Irish insurrection, he made great efforts to place the currency on a satisfactory basis. He drew up a table of specie which contained the values at which the various foreign coins then circulating would be recognised. In this list, with the British coins are found the Dutch Guelder,

NOTE 1.—The numbers refer to the source of reference, see Bibliography.
Letters in brackets refer to the volumes of the Historical Records of Australia.

the Spanish Dollar, the Venetian Ducat, the Portuguese Joana, and the East Indian Rupee. King suggested that a special coinage be made for the Colony, and he cut down the Spanish dollar to provide small change. These efforts met with no success, but he did succeed in inducing the British Government to send out £2,500 worth of copper pennies, which he ordered to circulate at twice their nominal value.

[Table of specie, 19th Nov., 1800. 1 (c), p. 39. King to Hobart, 20th Dec., 1804. 1 (e), p. 206.]

Another serious matter was forcing itself upon King. The presence in Australian waters of a French expedition, ostensibly engaged in scientific research, the unoccupied island of Tasmania, and the disquieting rumours of French colonial aspirations caused him grave concern. He resolved upon immediate action. Under his direction two parties were despatched to form settlements in Tasmania. The first party, commanded by Lieut. Bowen, was sent to the Derwent, the other, under the command of Colonel Paterson, went to Port Dalrymple, on the northern coast. Between the arrival of these small parties, an expedition despatched by the Home Authorities arrived at the Derwent. This expedition was commanded by Lieut.-Colonel David Collins, who had previous experience in New South Wales, and was a man in every way suited for the task of founding a new colony. Bowen's party achieved practically nothing beyond occupation. Paterson was more successful, but Collins started the real work of colonisation.

The records which are of use in the present study refer almost entirely to the settlements which were under the guidance of him and his successors.

B. THE TASMANIAN CURRENCY.

(a) Coinage.

(i) The Early Years, 1803-13.

From our meagre information there is no evidence to show that either Bowen, Collins, or Paterson brought any coin with them to Tasmania. However, we do know that before Collins had been six months at Sullivan's Cove he was unable to pay official salaries in coin. His predicament was similar to that of Phillip at Sydney, sixteen years before. (See Section A.) The immediate liabilities of the Government he met by an issue of official promissory notes, hoping to receive a supply of coin from Sydney. However, it was useless to expect help from that quarter. The passage of

time had not mitigated Governor King's difficulties. After the insubordination of the New South Wales Corps, the currency was among his worst worries. In his despatches to the British Ministers, he vividly describes the evils arising from the scarcity of coin. The few persons who possess Spanish dollars, he tells the Earl of Camden, engage in a usurious and ruinous traffic in spirits. His ill-fated successor, Bligh, was less fortunate. Dollars, he informs Windham, are hoarded for sinister purposes. In such circumstances it is not difficult to understand that the Tasmanian settlements in all probability received no remittance of coin from New South Wales during these years.

[Collins to Sullivan, 3rd Aug., 1804. 1 (l.) p. 261. King to Camden, 1805. 1 (e), p. 671. Bligh to Windham, 1807. 1 (f), p. 156.]

(ii) The Colonial Coinage (1813).

A new era commenced when Colonel Lachlan Macquarie became Governor-in-Chief of the Australian Colonies late in 1809. With characteristic energy he applied himself to settling the currency troubles once and for all. However, he soon found that with all his veering and tacking he was only following the course of his predecessors. His despatches to Lord Castlereagh on the subject were couched in strong terms, but still he failed to get a remittance of specie for some years. Fortunately for the colonies, and the Governor's peace of mind, the British Government at last, after nearly twenty years, sent another supply of coin to Australia.

[Macquarie to Castlereagh, 1810. 1 (g), p. 242.]

By an arrangement with the Directors of the East India Company, in 1812, £10,000 worth of Spanish dollars were shipped to Sydney.

It may appear strange that the British Government should issue Spanish coin for circulation within its own dominions; but the Spanish dollar was then almost a universal coin, and was already well known in Australia.

Macquarie held strong and often very original views upon finance and economy. In order to prevent the new dollars' inevitable disappearance by export, he took a curious measure. A circular piece measuring 11/16ths of an inch was struck out of each dollar. The remaining ring was stamped with the words "five shillings" on the obverse, and "New South Wales" on the reverse. The disc that had been struck out was also subjected to the following impressions:—

Obverse—A crown in centre; New South Wales above, 1813 below. Reverse—Fifteen pence in two lines. The edge being roughly milled with dies.

[Proclamation re issue of Holey and Dump dollars, 1813. 1 (a), p. 750-6. Also Chitty, 26.]

The first coin, the Holey or Ring dollar, was issued at the value of the original coin, five shillings. The centre piece, or Dump, became officially valued at fifteen pence. Thus the dollar was enhanced in value to the extent of 25 per cent. So by a few simple operations, Macquarie gave the Colony a currency which had at least some useful properties. The proclamation which announced the issue of what may be called the Colonial coinage, imposed severe penalties for clipping or otherwise mutilating these coins. Seven years' confinement, within the beneficent precincts of a Colonial prison, seems to have successfully overcome the temptation to clip an occasional handful of dollars, in Tasmania, at any rate.

Colonel Thomas Davey was now in command of the settlements of the island. His four years' administration is chiefly remembered from the prevalence of bushranging, and other lawlessness. Nevertheless, the Colony progressed. All food supplies were now locally produced, and the days of famine and dependence on New South Wales had passed away. Strangely enough, in all the correspondence between Macquarie and Davey, no reference can be found relating to a remittance of the Colonial coinage to Tasmania. It certainly circulated in the island, and if the reports of persons still living may be credited, it lingered in use late in the 'forties, long after its official withdrawal. Even to-day an occasional Dump is found in old houses. As the proclamation ordering withdrawal from issue was published in the *Hobart Town Gazette*, it is certain that it circulated in Tasmania.

West and Fenton, in their histories of Tasmania, mention the Colonial coinage, but they both state it was issued in the year 1810. We can positively assert that no such coins were issued before 1813. It is probable they were not as well informed about the matter as we are to-day.

[West (13), p. 76. Fenton (14), p. 54.]

Samuel Mossman, in his work *Our Australian Colonies*, says that in Tasmania, pieces the size of a shilling, at which value they circulated, were cut from the Spanish dollar. The ring left circulated at four shillings. Further, he says, that this money was scarce, being issued from the Government

Stores to the Contractors in provisions who held a monopoly, very little actually passing into circulation. From this it would appear that a separate coinage was issued in Tasmania. Absolutely no evidence can be found to support these statements. In a letter to the writer, Mr. Alfred Chitty, the well-known Australian numismatist, says:—

> "As these two coins have never been met with, numis-
> "matists consider that Mossman is in error, and that he
> "is confusing them with the Holey and Dump dollar.
> "For all that, there might be two such coins struck in
> "Hobart; if they could be found, they would be a prize.
> "Some of the dollars were freely stamped with the head
> "of George III., and many reached Australia and were
> "cut down. One thing I am pretty certain about is
> "that some half and quarter dollars were stamped with
> "the King's head in Tasmania."

[Mossman (15), p. 142.]

It seems possible the authorities at Hobart or Launceston stamped some dollars to suit their convenience. For ten years the Colonial coinage remained in circulation, and it appears to have been, and probably was, a benefit to the colonists.

In 1816, a small quantity of copper coin (£105 worth) was sent by Governor Macquarie to Tasmania, to supply the want of small change. Next year the enhanced value of copper coin, which had been unchanged since 1801, was reduced to its face value.

[From Summary of letters to Asst. Commissary General, Hobart, from Sydney, 28/6/1816. 1 (m), p. 605.]

Colonel William Sorell, who became Lieut.-Governor of Tasmania in 1817, carried into effect a policy which added materially to the prosperity of the Colony. He restored order, stimulated wheat growing, laid the foundations of the wool industry, and organised public finances. His administration left a lasting impression on the Colony.

The scarcity of specie was still an annoyance in small transactions, and an obstruction in the larger business relations of the colonists. It appears that Sorell made the best of the position, working as well as possible with the small supplies of coin in circulation. He constantly endeavoured to keep all official values expressed in sterling, despite the fact that the Spanish dollar was the commonest coin. The official notices in the *Hobart Town Gazette* are a contrast to the

private notices, advertisements, sales, and offers of reward. In the latter cases, when coin is mentioned at all, it is most often expressed in dollars.

(iii) Brisbane's Reforms.

More troubles lay ahead for those in authority in New South Wales and Tasmania. For twenty years, through the exigencies of the French Wars, the Bank of England had suspended gold payments. These were resumed in 1817, and had the effect of lowering the value of the Spanish dollar. The depreciation in England was considerable, the value falling to 4s. 2d., whilst in New South Wales and Tasmania, the dollar still circulated at five shillings. Hence it became extremely profitable to ship dollars to New South Wales. And this was what actually happened. Coghlan states that in 1822 two ships alone brought 80,000 dollars to Sydney. Goodwin, who wrote a little guide book for intending emigrants to Tasmania, very rightly advises them to invest in dollars before leaving England. Such a state of things could not continue, and Sir Thomas Brisbane, who succeeded Macquarie in 1822, resolved to settle the question at once by the quickest method possible, regardless of any hardship that might then result.

[Coghlan (22), p. 257. Goodwin (8), p. 37. Curr (7), p. 5.]

Brisbane held two views regarding the currency of the colonies. Firstly, that the Spanish dollar, and not sterling, was the best medium of exchange. Secondly, that the value of the dollar must be reduced (in terms of the British pound), and the colonists must bear the burden of this devaluation. He immediately set to work to put these views into practice. The steps taken were drastic, and the immediate results caused much hardship in New South Wales and Tasmania. Merchants found that they now had to pay nearly five dollars to the pound, where formerly they paid four, when purchasing Treasury Bills for remittance to their London Agents and creditors. The settlers that season discovered that the Government Stores only paid them for their crops in dollars at 4s. 2d., in place of the customary five shillings. As many had obtained credit, often at high rates, right up to the full value of their crops at the old rate, great suffering was caused. In the elder colony, Brisbane's policy was met with strenuous opposition from the Directors of the Bank of New South Wales, who championed the colonists' cause. A bitter controversy was waged. The

Secretary of State for the Colonies, the Earl of Bathurst, was appealed to by the Directors, but in vain, Brisbane's actions being generally upheld.

[Coghlan (22), p. 258-66. Memorial of Bank of N.S.W. to Brisbane. 1, (j), p. 730-2.]

In Tasmania, the results of these changes were disastrous to Sorell's careful administration, and caused considerable suffering. We are fortunately well informed of these events, as Sorell gave a very full account of them in a report he wrote to his successor, Colonel George Arthur, on leaving office in 1824. On the 31st May, 1822, Sorell says that the value of the Spanish dollar was suddenly reduced about 20 per cent. It is not difficult to imagine the hardship caused to the many new Tasmanian settlers by this sudden reduction in the value of their crops and other produce. On 27th June, sterling ceased to be the official coinage, and from that date all accounts were to be kept in dollars. Whether this order was entirely put into force is not at all clear. On 15th October of the same year, Sorell issued a General Order, fixing wages, all in sterling, dollars not being mentioned. Neither is it at all clear as to what had happened to Macquarie's Holey and Dump dollars of 1813. Official papers make no mention of their existence after 1814. The next fact known is that Brisbane declared the official value of the Holey dollar to be 2s. 9d., that is slightly more than half its 1813 value. Early in the next year, 1823, Government dues and salaries were paid in dollars. The dollar, it would seem, had become the current coin of the colonies. It is not known whether the confusion resulting from the Government in New South Wales being forced to recognise several values for the dollar existed in Tasmania. Coghlan states that in the Mother Colony the Commissariat paid for its supplies in dollars at 5s., the civil officers were paid in dollars at 4s. 4d., and the military in dollars at 4s. 8d. Certainly the introduction of dollars must have greatly complicated book-keeping. The writer has seen account books of the period ruled with two sets of figure columns, one for sterling, the other for dollars.

Sorell's remarks to Arthur on the reforms of the two preceding years furnish us with a contemporary view of the position. He says:—

> "Upon the subject of the Exchange, I confess I did "not consider the Dollar System in itself alone a subject "of complaint, though it might even be a question how

"far it was applicable to these Colonies, and how far they "could yet bear it, for it exists in most, if not all, the "British Colonies, and I believe upon the Same Prin- "ciples. It is, however, to be considered that other "Colonies have an established and Native Commerce, and "that these young colonies, affording yet but little in the "way of export, must consequently discharge a large "portion of their obligations and expenses in money remit- "tance, the means of doing which must depend mainly "on their agriculture and the fostering encouragement of "the Mother Country. But the treble operation of the "Exchange, the reduction of prices, and the termination "of the relations between the Government and the "Grower, and the diminution of the quantity purchased, "is attended by other effects, resulting from the present "State of the Currency."

The clamour against the dollar system and subsequent events evidently made the British Government pay more attention to the New South Wales currency. A large amount of British coin was sent out, and many of the old troubles disappeared.

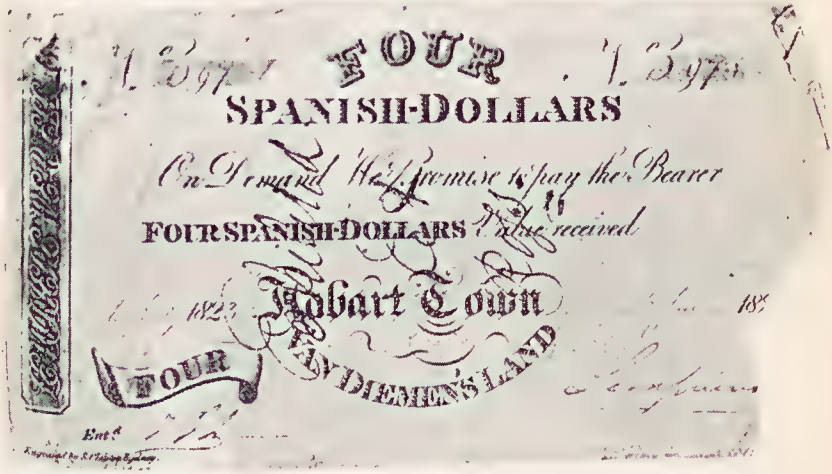
The story had not such a happy ending in the case of Tasmania for many years. In 1826, a year later than the end of the period covered by this paper, an article appeared in the *Colonial Times* (6th October, 1826), in which the writer deplores the lack of specie owing to exportation. He sighs for the good old days of Holey Dollars and Dumps.

[*Colonial Times* (11).]

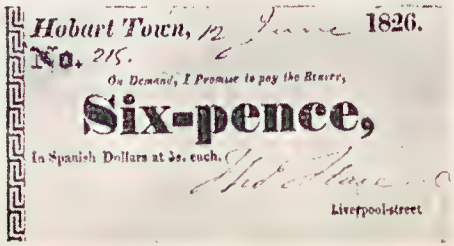
(iv) McIntosh-Degraves Tokens.

The lack of metallic money induced two enterprising immigrants to bring a small quantity of silver shilling tokens with them from England. This token, originally issued by the firm McIntosh and Degraves, sawmillers, Cascades, Hobart, passed into circulation in 1823. It was the first token to be issued in Australia, and specimens are now highly prized by coin collectors. The actual number of these tokens that was issued is unknown, but it is considered that their value did not exceed £100.

We must now pass on and view the expedients that Colonists were driven to employ through the inadequate supply of coin during these days.



Hobart Town, 16 May 1826.
No. D 294.
On Demand, I Promise to pay the Bearer,
Three-pence,
In Spanish Dollars at 5s. each.
Liverpool-street



PRIVATE PROMISSORY NOTES.

NATIONAL MUSEUM MELBOURNE

(b) Paper Money.

(i) Official Notes.

The issue of official promissory notes by Collins has already been mentioned. The circumstances which forced him to adopt that course are easily understood from a despatch he wrote to his official superiors in England:—

> "For the want of specie in the colony to pay the "superintendents and overseers their respective salaries, "by means of which they found themselves unable to "purchase several articles of use and comfort which had "been brought hither in vessels from Sydney, I have "directed the Commissary to issue small Promissory "Notes, not less than £1 sterling in value, which have "proved a great accommodation to these people."

[Collins to Sullivan, 3rd Aug., 1804. 1 (1), p. 261. King to Collins, 30th Sept., 1804. 1 (1), p. 284.]

Only £615 worth of these Colonial Notes were issued, the shipmasters then lying in the Derwent receiving them in payment for the sales of goods they had effected. These notes were then consolidated with Treasury Bills on presentation. Governor King, at Sydney, quite approved of the course taken by Collins in this instance. But King had learnt from bitter experience to appreciate the abilities of the note forgers at Sydney. He particularly enjoined Collins to keep the issue within the limits of Tasmania. "I am "sorry," says King, "means are now used here to counterfeit "them, which may lead to a complicated and extensive evil." When we remember the privations endured by the first settlers, the truth of Collins's remarks concerning these notes becomes apparent. "They would greatly tend," he says, "towards smoothing difficulties that must ever present themselves in the Infancy of a distant settlement like this."

[Collins to Hobart, 20th Feb., 1805. 1 (1), p. 305.]

The earliest attempts to raise crops gave the most discouraging results. The settlers were in many cases inexperienced in any form of agriculture, their labour was inefficient, and their implements often faulty. Years had to pass before they understood the climatic conditions and the specific properties of the soil. When a settler succeeded in harvesting a crop, he took it to the Government Stores at Hobart or Launceston. As he could not be paid in coin, he received a receipt on which was stated the quantity of wheat he had sold, and the amount the Government owed him. This sum

the authorities undertook to pay on presentation of the receipt in the near future, generally three months hence. Now the settler had debts to pay, and other business to transact with the town merchants and traders. Unless he had enough money in coin, which was very unlikely, he was forced to make these little adjustments with his Stores Receipts. Naturally enough, the receipts accumulated in the hands of the importing merchants, who presented them at the Government Stores when the time for consolidation fell due. The merchants received drafts on the British Treasury for their bundles of receipts, which enabled them to pay their London agents for the goods sent out on their account.

In a colony where good coin was scarce, and bad paper abundant, these Stores Receipts formed a most important part of the currency. But it was essential that the authorities entrusted with their issue should be careful in their methods, and keep their eyes continually on the watch for forgeries. There were, during the period, one or two instances of fraud on the part of officials. Nevertheless, when Commissioner Bigge issued his report, pleasing facts became known. It transpired that one official, who had been responsible for some years for issuing Stores Receipts, passed £180,000 worth through his hands, and had not seen one forgery. The chief trouble, the authorities found, was getting the holders to present the receipts they held at the right time, when they were due, not six months after that date.

[Bigge's Report, 3. Account of Bigge's examination, see 1 (n).]

Below is a copy of the form of Stores Receipts issued in 1820.

December, 1820.

£0 0s. 0d. Sterling. Hobart Town.

No.

I promise to pay.....or Order, the Sum of.....Pounds..... Shillings and.....pence sterling for.... Bushels of Wheat delivered by him into His Majesty's Stores at this place, at the rate of .....per bushel.

Per

G. Hull.

To be brought in for consolidation on the 25th.

NOTE 2.—The word consolidation was used in reference firstly to the redemption of official promissory notes, passing then into general use. It appears to have originated from its use in public finance in the eighteenth century, e.g., Consolidated Fund, both in Great Britain and America.

To a much less extent the Military and Police Departments, who arranged their own Commissariat, issued receipts in a similar manner to the Government Stores. These notes likewise passed into circulation.

Hobart Town,
24th April, 1822.

No. 122.

I promise to pay bearer the sum of One Pound Sterling for subsistence of the 73rd Regiment.

(Sgd.) MAJOR GEILS.

(ii) Private Promissory Notes.

Where the Government had shown the way, the colonists were not slow to follow. As in New South Wales, persons of all degrees of wealth issued their own promissory notes. The value of these notes depended, of course, on the ability and the willingness of the persons who issued them to honour them on demand. Notes of all values from pounds to pence were current. Such values as 5s. 8d., 7s. 10d., 9s. 6d., and 15s. 2d. are characteristic examples. To-day it would appear decidedly humorous for a Hobart citizen to give a note promising to pay threepence in Spanish dollars at five shillings. Obviously many notes were merely artifices to obtain credit. The crudity of a great number of notes left their issuers exposed to all the acts of the fraudulently inclined. Still, the colonist of that day dare not be over-fastidious in rejecting the note of a neighbour, for retaliation might some day be highly embarrassing. West in his history of Tasmania gives us a good idea of this part of the currency:—

> "The credit of these notes depended largely on the "Naval Officer; a sort of collector; if admitted in the "payment of duties they were current everywhere."
>
> [Hyman (25), p. 38. West (13), p. 76.]

The writer has not seen any specimens of notes bearing a date earlier than 1810. They were certainly issued before that year, as in the General Orders for 2nd February, 1808, appears Bligh's proclamation commanding all persons to affix sterling values on their notes.

[General Orders, 1808. 1 (1), p. 561.]

Merchants and tradesmen with a high standing in the community issued notes which had been prepared with a certain amount of engraver's skill, making forgery difficult. The notes of Lempriere & Co. furnish an example. There is a striking contrast in the elegant notes of this firm to many of the miserable rags that passed in circulation. Sorell in his report to his successor in office, Arthur, to which reference has already been made, stated:—

> "A spurious paper currency here has tended "materially to aggravate the pressure. Some few re- "sponsible houses had issued paper greatly to the public "convenience and advantage; but numerous speculators "followed till the usual consequences ensued, inability in "many cases to pay."

A little insight into the manner in which business was carried on is revealed by an advertisement in the *Hobart Town Gazette*, 4th January, 1817.

> GENERAL GOODS—Richard Lewis.
>
> Prompt payments to be made in Mr. Hogan's Notes, Stores Receipts, Police Fund Bills, Captain Nairn's, Mr. E. Lord's, Mr. Abbott's, Mr. Gatehouse's, or Mr. Ingles' Notes or good wheat at Stores Price.

(c) Primitive Methods of Exchange.

(i) Barter with Produce.

A settler coming to town with a bullock waggon of wheat generally wanted to get his business done as quickly as possible. He may have become impatient by the endless haggling with the buyer of his produce over the doubtful value of the promissory notes offered in payment. For this man, custom provided a swifter method for settling his business. It was quite usual from the earliest days for wheat and other produce to be exchanged for goods. Again, if Hull's authority is to be accepted, the Government led the way in 1808, by allowing settlers to pay their debts to the Crown in wheat. During the span of two decades for which the Dependency Period lasted, the transaction of business by means of barter was an every-day occurrence. It is

the one fact upon which all authorities agree. Persons at either end of the scale of wealth resorted to this method of satisfying their wants. Numerous examples can be cited. The two below are taken from that invaluable source of information, the *Hobart Town Gazette*:—

> August 10th, 1816.
>
> To be sold at the Warehouse of Mr. Lord, Macquarie-street—7 casks of Virginia Leaf Tobacco, 3 years' credit will be given. Payment to be made in Wheat or Meat at the Storehouse Price.

In the same year, 16th November, wheaten bread is advertised at ten pence for a four-pound loaf, or four pounds of wheat taken in payment. Later in the period, the next advertisements are characteristic of those which appeared in almost every issue of the paper.

> August 6th, 1824.
>
> FOR SALE—Wrought Iron Hurdles. Sheep, Cattle, or Wheat will be taken in exchange.

On 13th August, 1825, Mr. Thomas Atkinson, of Campbell Street, Hobart, offers, amongst other goods, tea, per ship *Phœnix*—"For which," he says, "Wheat, barley, oats, wool, "or any other Colonial produce will be taken in payment."

There is a doubtful story which has appeared in print that the first cargo of Tasmanian wool exported was sold in exchange for merchandise to the skipper of a British Ship at Hobart, in 1819. As Sorell, who took particular interest in the wool industry, makes no mention of it in his papers, the story cannot be accepted. No doubt, however, large quantities of provisions were sold to ships in port in exchange for settlers' requirements. The widespread practice of barter of goods in the Colony helps us to realise how totally inadequate was the supply of coin, and how unreliable were the paper substitutes. Before leaving the subject, it will be of interest to briefly touch on one of the results brought about by this state of affairs.

(ii) The Rum Currency.

Naturally enough an article which was at once easily recognisable, readily transported, and in universal demand

attained almost the dignity of currency, and spirits bearing the general designation of rum came to play this important part in Colonial life. This statement is not the outcome of magnifying small isolated facts. The rum currency existed in Tasmania well on into Sorell's days (1817-24), but it does not seem to have reached the proportions it did in New South Wales. In the Mother Colony, Hunter, King, and Bligh used every means in their power to suppress it, but with little success. Macquarie found himself forced to recognise it in the payment of wages.

Collins found that by paying part of the wages of his workmen in rum, the community was got under shelter far more quickly than it would have been otherwise. Davey, his successor, did not appear to be impressed with the evils arising from the rum currency. However, in a despatch to the Earl of Bathurst, he bitterly complains of the effects of Rum Monopoly granted to a group of Sydney Speculators by Macquarie. He points out that, owing to the right of importing spirits into the Colonies being given to three persons, the revenue of Tasmania, which was largely derived from the duties on spirits, fell considerably. The justice of the complaint cannot be discussed here, but it shows the importance of rum on affairs of administration.

[Davey to Bathurst, 30th April, 1816. 1 (m)', p. 147.]

Sorell gave no encouragement to the use of spirits for making payments. In the General Orders for 17th November, 1821, he reminds colonists of a Proclamation given by the Governor-in-Chief in 1815, absolutely prohibiting the barter of spirits, and particularly their use in paying wages. In this Order, Sorell declares it "a practice pregnant with in-"jurious effects, and known to have increased of late in the "country districts." He proceeds, "His Honour feels it his "duty, at this time, to caution all persons for selling, paying, "or bartering with spirits that they are alike subject to the "law, which imposes a penalty on such retailing of spirits, "and it is the determination of the Magistracy to enforce the "law in every case brought before them after December 31st, "1821."

[*H. T. Gazette*, 17th Nov., 1821.]

It can hardly be expected that goods would be advertised for sale with spirits demanded in payment, but that rum was offered for rewards, if we are to believe a writer in

the *Gazette*, and was used in part payment for a wife, is shown by the following:—

"1 Bottle of Rum.

"Strayed on Thursday night, late, from the premises "of Mr. Kennedy, in Collins Street, a small kangaroo. "Whoever may find same, and bring it to its owner at "Mr. Kennedy's, will receive the above-named."

"Some time ago, an inhabitant of this settlement "sold his wife to another for 50 ewes, within a few days "another husband, bent on raising the wind, brought his "spouse to market, but the sale being dull only procured "for him £5 and a gallon of rum."

The writer cannot vouch for the reliability of this report.

On 3rd December, 1825, the Government of Tasmania was separated from New South Wales. Development during the dependency period had been rapid. From the little community of 400 people, who landed with Collins in 1804, in the wooded cove on the west shore of the Derwent, it had grown to a prosperous colony, boasting a population of over 14,000 persons. Every year more emigrants were arriving, and more soil was cultivated. Progress in commerce was assisted by the foundation of the Van Diemen's Land Bank in 1824, by a group of local capitalists. Although the Bank issued notes, the subject of early banking could not be adequately dealt with within the limits of this paper. Although the currency was not in a state which we could term satisfactory to-day, when the period ended, the worst days were passed, and the forces were working which were to wipe out for ever the troubles of the earlier years.

C. ACKNOWLEDGMENTS.

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Vol. 4 (1803-1804)	(d)	Vol. 3 (1820)	(n)
Vol. 5 (1804-1806)	(e)	Vol. 4 (1821-25)	(o)
Vol. 6 (1806-1808)	(f)		
Vol. 7 (1809-1813)	(g)		
Vol. 8 (1813-1816)	(h)	Series IV. Legal Papers.	
Vol. 9 (1816-1818)	(i)		
Vol. 10 (1819-1822)	(j)	Vol. 1 (1788-1827)	(p)
Vol. 11 (1823-1825)	(k)		

2. Sorell.—Draft despatches of Lieut.-Gov. Sorell from Hobart, Dec. 1818, to April, 1825. MSS. Govt. House, Hobart.

3. Bigge.—Reports of Commissioner of Inquiry on the state of the colony of N.S.W., etc. Parliamentary Papers, 1823.

4. Hull.—Statistics of early Tasmania. House of Assembly Jor., 1856 (paper 2).

B. Accounts Written During the Period.

5. Knopwood.—Diary written 1803-05. MSS. Mitchell Library, Sydney.

6. Wentworth.—Statistical, Historical, and Political description of the colony of New South Wales, and its Dependent settlement in Van Diemen's Land, 1819.

7. Curr.—An account of the colony of Van Diemen's Land, 1824.

8. Goodwin.—Emigrant's guide to Van Diemen's Land, 1823.

9. Evans.—Geographical and Historical and Topographical description of Van Diemen's Land, 1822.

C. NEWSPAPERS, ETC.

10. The *Hobart Town Gazette*, 1816-25.
11. The *Colonial Times* (Hobart), 1825-6.
12. The *Van Diemen's Land Almanack*, 1824.

D. HISTORIES.

(General.)

13. West.—The History of Tasmania, Vol. 1803-52.
14. Fenton.—A History of Tasmania, 1642-1884.
15. Mossman.—Our Australian Colonies.
16. Walker (J. B.)—The Discovery and Occupation of Port Dalrymple.
17. Walker (J. B.)—The founding of Hobart by Lieut.-Gov. Collins. Pap. Proc. Roy. Soc., Tas., 1889.
18. Giblin.—Notes in aid of a history of the early days of Tasmania (1788-1825.) MSS. Chief Sec. Dept., and Roy. Soc. Library, Hobart.
19. Walker (F.).—Some notes on the history of Tasmania. Jor. and Proc. Roy. Aust. Hist. Soc., Vol. VI., part VI., 1920.
20. Thomas (Miss L.)—The establishment of New South Wales in 1788. Jor. and Proc. Roy. Aust. Hist. Soc., Vol. XI., part II., 1925.
21. Scott.—A short history of Australia, 1915.

(Economic.)

22. Coghlan.—Labour and Industry in Australia. Vol. i. (parts 1 and 2).
23. Campbell.—The East India Co. and Australian trade. Jor. and Proc. Roy. Aust. Hist. Soc., Vol. IV., part 3, 1918.
24. McKern.—State Industrial activities in Australia (1822-23). Jor. and Proc. Aust. Hist. Soc. Vol. X., part I, 1923.

E. NUMISMATICS.

25. Hyman.—Coins, Coinages, and Currency of Australasia. Published by N.S.W. Govt.
26. Chitty.—Early Australian Coinage. British Numismatic Jor. Vol. IV., 1907.

The Royal Society of Tasmania

ABSTRACT OF PROCEEDINGS

1925.

9th MARCH, 1925.

Annual Meeting.

The Annual Meeting was held on the 9th March at the Royal Society's Rooms, Tasmanian Museum, Hobart, the President of the Society, His Excellency Sir James O'Grady, K.C.M.G., presiding. Mr. L. Rodway, on behalf of the Society, extended a welcome to His Excellency as President of the Society. His Excellency in reply expressed his pleasure at being present, and hoped that during his stay in Tasmania he would be able to assist the Society.

The Annual Report was read and adopted. The following were elected members of the Council for 1925:— Mr. L. Rodway, Right Reverend R. S. Hay, Mr. W. H. Clemes, Dr. W. E. L. Crowther, Mr. W. H. Cummins, Major L. F. Giblin, Messrs. J. A. Johnson, A. N. Lewis, Dr. Sprott, and Mr. Lord (*ex officio*).

Papers.

The following papers were read:—

"Tasmanian Giant Marsupials." By H. H. Scott and Clive Lord.

"Some Notes on a Tasmanian Aboriginal Skull." By H. H. Scott and Dr. McClinton.

The following were elected members of the Society:— Miss H. Alexander, Messrs. W. Coogan, G. Cunningham, Mrs. Cunningham, Miss M. L. Reid, Messrs. R. Nettlefold and M. L. Urquhart.

Illustrated Lecture.

Mr. L. Rodway delivered an illustrated lecture on "Some Plants of the National Park (Mount Field)."

Conversazione.

At the conclusion of the meeting a Conversazione was held in the Art Gallery.

15th APRIL, 1925.

The Monthly Meeting was held in the Society's Rooms, on the 15th April, Mr. L. Rodway, Vice-president, presiding.

Papers.

The following papers were read:—

"The Basis of the Physical World as Indicated by Carrying as Far as Possible the Tenets of Relativity." By Professor A. McAulay.

"On the Occurrence of *Wolffia* in Tasmania." By L. Rodway.

Illustrated Lecture.

"The Aboriginal Camping Grounds of the North-West Coast of Tasmania." By Dr. R. Pulleine.

7th MAY, 1925.

The Monthly Meeting was held at the Society's Rooms on the 7th May, His Excellency Sir James O'Grady, K.C.M.G., presiding.

R. M. Johnston Memorial Lecture.

Professor F. Wood-Jones, D.Sc., F.R.S., delivered the R. M. Johnston Memorial Lecture for 1925, the subject of the lecture being "The Mammalian Toilet and Some Considerations Arising from It."

Presentation of the R. M. Johnston Memorial Medal.

Professor Wood-Jones was presented with the R. M. Johnston Memorial Medal for 1926.

9th JUNE, 1925.

The Monthly Meeting was held at the Society's Rooms on the 9th June, Mr. L. Rodway, C.M.G., presiding.

The following were elected:—As Honorary Member, Professor F. Wood-Jones; as Corresponding Member, Dr. R. Pulleine; as Ordinary Members, Professor J. B. Brigden, Reverend B. Semmens, and Miss E. Giblin.

Illustrated Lecture.

"The Hands of Animals. A Chapter in Evolution." By E. E. Unwin, M.Sc.

13th JULY, 1925.

The Monthly Meeting was held in the Society's Rooms on the 13th July, Mr. L. Rodway presiding. The following were elected members:—Sir Alfred Ashbolt, Messrs. K. Shoobridge and D. C. Pearse.

Mr. Rodway drew attention to the present state of Lady Franklin's Museum, and moved:—"That in the opinion of this meeting, it is not being put to the use for which it was intended, and the Government be urged to resume it in the public interests." The resolution was carried.

Mr. P. B. Nye, on behalf of Dr. A. B. Walkom, read his paper, "Notes on Some Tasmanian Mesozoic Plants, Part 2."

Illustrated Lecture.

"A Review of the Birds of Tasmania." By M. S. R. Sharland.

Mr. W. F. D. Butler, Chairman of the Historical Section, drew attention to the fact that 3rd December, 1925, was the centenary of the Constitutional Independence of Tasmania, and made several suggestions for consideration by the Council, with a view to marking the event in a suitable manner.

10th AUGUST, 1925.

The Monthly Meeting was held in the Society's Rooms on the 10th August, Mr. L. Rodway, C.M.G., presiding.

Papers.

The following papers were read:—

"On a Phyllocarid from Tasmania." By F. Chapman.

"The Eared Seals of Tasmania." By H. H. Scott and Clive Lord.

Lecture.

"Native Tribes of New Guinea." By Minor Canon C. C. Robertson.

14th SEPTEMBER, 1925.

The Monthly Meeting was held in the Society's Rooms on the 14th September, Mr. L. Rodway, C.M.G., presiding.

The following were elected members of the Society:—Messrs. A. L. Butler, G. L. Propsting, Norman Walker, and M. W. Winch.

Illustrated Lecture.

"Forestry, the Production of Soft Woods in Tasmania." By Lieutenant-Colonel Lane.

25th SEPTEMBER, 1925.

A Special Meeting of the Society, in conjunction with the Tasmanian Field Naturalists' Club, was held on the 25th September at the Society's Rooms, Mr. L. Rodway, C.M.G., presiding.

Dr. William Colin MacKenzie, Director of the National Museum of Australian Zoology, delivered an Illustrated Lecture upon the "Scientific Importance of the Australian Fauna."

12th October, 1925.

The Monthly Meeting was held in the Society's Rooms on the 12th October, Mr. L. Rodway, C.M.G., presiding.

Sir Alfred Ashbolt presented the Society with a series of notes from Captain Booth's diary, prepared in London by Mr. Ronald Giblin, with the consent of Major Richmond, the owner of the original diary.

Papers.

"A Review of the Tasmanian Lepidoptera." By Dr. Jefferis Turner.

"New and Little-known Tasmanian Lepidoptera." By Dr. Jefferis Turner.

Lecturettes.

A series of Lecturettes dealing with the period during which Sir John Franklin was Governor of Tasmania were given by members of the Historical Section.

9th November, 1925.

The Monthly Meeting was held in the Society's Rooms on the 9th November, 1925, Mr. L. Rodway presiding.

Papers.

"Notes on the Journal of Captain C. O'Hara Booth." By R. W. Giblin, F.R.G.S.

"Tasmanian *Araneidæ*." By V. V. Hickman, B.Sc.

"Notes on Some Rare and Interesting Cryptogams." By L. Rodway, C.M.G.

Lecturette.

Sir Alfred Ashbolt delivered a lecturette concerning Captain Booth's Diary.

14th December, 1925.

The Monthly Meeting was held in the Society's Rooms on the 14th December, Mr. L. Rodway presiding.

Papers.

1. "Australian Fauna and Medical Science." By Professor William Colin MacKenzie, M.D., F.R.C.S., F.R.S. (Edin.).
2. "Notes on Early Tasmanian Currency." By J. Reynolds.
3. "The Eared Seals of Tasmania, *Arctocephalus tasmanicus, sp. nov.*" By H. H. Scott and Clive Lord.
4. "Tasman's Landing Place." By G. H. Halligan, F.G.S.

Illustrated Lecturette.

"The Location of Tasman's Landing Place in 1642." By G. H. Halligan, F.G.S.

ANNUAL REPORT

1925.

The Royal Society of Tasmania

Patron:

HIS MAJESTY THE KING.

President:

HIS EXCELLENCY SIR JAMES O'GRADY, K.C.M.G.

Vice-Presidents:

L. RODWAY, C.M.G.

A. H. CLARKE, M.R.C.S., L.R.C.P.

Council:

(Elected March, 1925)

L. RODWAY, C.M.G. (Chairman)
RT. REV. R. S. HAY, D.D.
W. H. CLEMES, B.A., B.Sc.
W. E. L. CROWTHER, D.S.O., M.B.
W. H. CUMMINS, A.I.A.C.
L. F. GIBLIN, D.S.O.
J. A. JOHNSON, M.A.
A. N. LEWIS, M.C., LL.M.
CLIVE LORD, F.L.S.
G. SPROTT, M.D., C.M.

Standing Committee:

W. H. CLEMES, L. F. GIBLIN, L. RODWAY, C. LORD.

Hon. Treasurer:

W. E. L. CROWTHER, D.S.O., M.B.

Editor:

CLIVE LORD, F.L.S.

Auditor:

R. A. BLACK.

Secretary and Librarian:

CLIVE LORD, F.L.S.

LIST OF MEMBERS

Honorary Members:

David, Sir T. W. Edgeworth, K.B.E., C.M.G., B.A., F.R.S., F.G.S. Professor of Geology and Physical Geography in the University of Sydney, the University, Sydney.

Mawson, Sir Douglas, B.E., D.Sc., O.B.E. Professor of Geology and Mineralogy, the University, Adelaide.

Spencer, Sir William Baldwin, K.C.M.G., M.A., D.Sc., Litt. D., F.R.S. Melbourne.

Wood-Jones, Professor F., M.B., B.S., M.R.C.S., L.R.C.P., D.Sc., F.R.S. The University, Adelaide.

Corresponding Members:

Year of Election.	
1901	Benham, W.B., M.A., D.Sc., F.R.S., F.Z.S. Professor of Biology, University of Otago, Dunedin, N.Z.
1892	Bragg, W. H., M.A., F.R.S. Professor of Physics in the University College, London.
1901	Chapman, R. W., M.A., B.C.E. The University, Adelaide.
1875	Liversidge, Professor A. "Fieldhead," Coombe Warren, Kingston, Surrey, England.
1923	Pulleine, R., M.B. 163 North Terrace, Adelaide.
1902	Smith, R. G., D.Sc. Linnean Hall, Linnean Society of N.S.W., 16 College Street, Sydney.
1892	Thompson, G. M., F.L.S. Dunedin, N.Z.
1901	Wall, A., M.A. Canterbury College, Christchurch, N.Z.

Life Members:

1918	Avery, J. 52 Southerland Road, Annadale, Melbourne.
1908	Baker, H. D. American Consular Service, Washington.
1890	Foster, Lieut.-Colonel Henry. "Merton Vale," Campbell Town.
1905	Foster, J. D. "Fairfield," Epping.
1905	Grant, C. W. "High Peak," Huon Road.
1921	Harvey, D. H. "Manresa," Lower Sandy Bay.
1922	Jones, Sir Henry, Kt. Campbell Street, Hobart.
1894	Mitchell, J. G. Parliament Street, Sandy Bay.
1896	Sprott, G., M.D. Town Hall, Hobart.

Year of Election.	Members:
1921	Anderson, G. M., M.D., C.M. Clare Street, New Town.
1923	Agnew, Miss K. Augusta Road, New Town.
1925	Alexander, Miss H. Brown's River.
1921	Allen, D. V., B.Sc. Launceston Technical School, Launceston.
1924	Allen, F. A. 13 Franklin Street, West Hobart.
1925	Ashbolt, Sir Alfred. "Lenna," Battery Point.
1921	Baker, H. S., LL.B., M.A. Griffiths, Crisp, and Baker, Collins Street, Hobart.
1887	Barclay, D. 143 Hampden Road, Hobart.
1921	Barr, J. S., M.D. (Glasgow). Lower Sandy Bay.
1890	Beattie, J. W. 28 Jordan Hill Road.
1918	Bellamy, H., J.P., M.Am. Soc. C.E., M.I. Mech. E., F.R. San.I. Government Hydraulic Engineer, Adelaide.
1924	Bennett, Dr. H. W., L.D.S., D.D.S. Brisbane Street, Launceston.
1903	Bennett, W. H. Ashby, Ross.
1921	Bertouch, V. von. Wellington Square Practising School, Launceston.
1921	Bethune, Rev. J. W. Church Grammar School, Launceston.
1922	Biss, F. L. U.S.S. Co., Hobart.
1912	Black, R. A. Department of Agriculture, Hobart.
1909	Blackman, A. E. Franklin.
1920	Blaikie, T. W. Practising School, Elizabeth Street, Hobart.
1918	Bowling, J. "Barrington," Tower Road, New Town.
1924	Booth, N. P. Messrs. Cadbury-Fry-Pascall Ltd., Claremont.
1925	Bowden, F. B. Jordan Hill Road.
1925	Bowerman, Captain. Marine Board, Hobart.
1923	Breaden, J. C. 12 Waverley Avenue, New Town.
1923	Brett, R. G. 53a Hill Street, Hobart.
1917	Brettingham-Moore, E., M.B., Ch.M. Macquarie Street, Hobart.
1925	Brigden, J. B., B.A. Tasmanian University, Hobart.
1911	Brooks, G. V. Director of Education, Hobart.
1922	Brownell, C. C. 117 Hampden Road, Battery Point.

Year of Election.

1907 Brownell, F. L. "Berwyn," Mercer Street, New Town.

1924 Budge, E. A., B.Sc. 302 Argyle Street, Hobart.

1918 Burbury, Frederick. "Holly Park," Parattah.

1919 Burbury, Charles. "Brookside," Moonah.

1925 Butler, A. L. Lower Sandy Bay.

1923 Butler, Mrs. G. H. Augusta Road, New Town.

1909 Butler, W. F. D., B.A., M.Sc., LL.B. Bishop Street, New Town.

1921 Butler, Reverend W. Corly. The Parsonage, Melville Street, Hobart.

1924 Calver, C. W. 112 Brisbane Street, Launceston.

1920 Cane, F. B. 90 High Street, Sandy Bay.

1913 Chepmell, C. H. D. Clerk of the Legislative Council, Hobart.

1920 Clark, W. I., M.B. Macquarie Street, Hobart.

1896 Clarke, A. H., M.R.C.S., L.R.C.P. "The Glen," Private Bag, St. Mary's.

1918 Clarke, T. W. H. "Quorn Hall," Campbell Town.

1910 Clemes, W. H., B.A., B.Sc. Clemes College, Hobart.

1922 Collier, J. D. A. The Librarian, Tasmanian Public Library, Hobart.

1925 Coogan, W. Lord Street, Sandy Bay, Hobart.

1924 Corstorphan, W. A. Toorak Avenue, New Town.

1924 Crabtree, R. W. The University, Hobart.

1920 Cranstoun, Mrs. F. A. 6 Gregory Street, Sandy Bay.

1924 Crisp, Cecil C. Lower Sandy Bay.

1911 Crowther, W. L., D.S.O., M.B. Macquarie Street, Hobart.

1917 Cullen, Rev. John. Macquarie Street, Hobart.

1918 Cummins, W. H., A.I.A.C. Manager, *The Mercury* Office, Hobart.

1925 Cunningham, Mrs. G. 22 Augusta Road, New Town.

1925 Cunningham, G. 22 Augusta Road, New Town.

1922 Davidson, R. Temple Chambers, Macquarie Street, Hobart.

1924 Davies, G. B. 111 Patrick Street, Hobart.

1919 Davies, H. W. "Abermere," Mount Stuart.

1923 Davis, Alfred. Lord Street, Sandy Bay.

1923 Davis, Charles. Red Chapel Road, Lower Sandy Bay.

Year of Election.

1908 Dechaineux, L. Technical College, Hobart.

1903 Delany, Most Rev. Patrick. Archbishop of Hobart. 99 Barrack Street.

1921 Dryden, M. S. 13 Hillside Crescent, Launceston.

1921 Eberhard, E. C. Charles Street, Launceton.

1923 Edwards, Hon. F. B., M.L.C. Ulverstone.

1919 Elliott, E. A., M.B. Main Road, New Town.

1918 Ellis, F. Education Department, Hobart.

1921 Emmett, E. T. Railway Department, Hobart.

1921 Erwin, H. D. Hutchins School, Hobart.

1918 Evans, L. Acting Director of Agriculture, Hobart.

1921 Eyre, H. Manual Training School, Launceston.

1902 Finlay, W. 11 Secheron Road, Hobart.

1918 Fletcher, C. E. Education Department, Hobart.

1921 Forward, J. R. Mechanics' Institute, Launceston.

1921 Fox, Miss. Ladies' College, Launceston.

1918 Gatenby, R. L. Campbell Town.

1923 Gibbings, R. A. C. 28 Antill Street, Hobart.

1922 Giblin, A. V. King Street, Sandy Bay.

1925 Giblin, Miss Ella. 326 Macquarie Street, Hobart.

1908 Giblin, Major L. F., D.S.O., B.A. Davey Street, Hobart.

1924 Giblin, W. W., M.R.C.S., L.R.C.P. Macquarie Street, Hobart.

1923 Gorringe, J. A. Kempton, Tasmania.

1923 Gould, H. T. Liverpool Street, Hobart.

1924 Gray, H. Fitzroy Place, Hobart.

1923 Green, Dr. A. W. 30 Parliament Street, Sandy Bay.

1921 Hall, E. L. 38 Lyttleton Street, Launceston.

1922 Halligan, G. H., F.G.S. "Hazeldene," Burns Road, Wahroonga, N.S.W.

1918 Harrap, Lieutenant-Colonel G. Launceston.

1924 Hawker, Mrs. J. F. 204 Davey Street, Hobart.

1919 Hay, Rt. Rev. R. S., D.D. Bishop of Tasmania, Bishopscourt, Hobart.

1924 Henry, Dr. C. C., M.B., F.R.C.S. St. John Street, Launceston.

1924 Heritage, F. W. Collins Street, Hobart

1921 Heritage, J. E. Frederick Street, Launceston.

Year of Election.

1921 Heyward, F. J., F.R.V.I.A. 43 Lyttleton Street, Launceston.

1915 Hickman, V. V., B.Sc. Mulgrave Crescent, Launceston.

1914 Hitchcock, W. E. Moina, Tasmania.

1921 Hogg, W. Public Buildings, Launceston.

1918 Hogg, G. H., M.D., C.M. 37 Brisbane Street, Launceston.

1922 Hood, F. W. Customs House, Hobart.

1921 Horne, G., V.D., M.D., M.S., Ch.B. Lister House, Collins Street, Melbourne.

1923 Hudspeth, W. H. "The Nook," Lower Sandy Bay.

1923 Hungerford, Mrs. "Red House," Fern Tree.

1923 Hungerford, Miss. "Red House," Fern Tree.

1923 Hurst, Miss R. 39 Bay Road, New Town.

1909 Hutchison, H. R. 1 Barrack Street, Hobart.

1922 Huxley, G. H., M.A. Kent Avenue, West Hobart.

1913 Ife, G. W. R., LL.B. Mortimer Avenue, New Town.

1925 Irby, L. G. Conservator of Forests, Forestry Department, Hobart.

1898 Ireland, E. W. J., M.B., C.M. Launceston General Hospital, Launceston.

1919 Jackson, George A. 79 Collins Street, Hobart.

1906 Johnson, J. A., M.A. Training College, Hobart.

1922 Johnson, W. R. Clemes College, Hobart.

1922 Johnston, J. R. Murray Street, Hobart.

1921 Judd, W., M.A. College Street, Launceston.

1911 Keene, E. H. D., M.A. Burnie.

1922 Kemp, Andrew. Stoke Street, New Town.

1922 Kennedy, J. 96 Montpelier Road, Hobart.

1924 Kennedy, Mrs. J. 96 Montpelier Road, Hobart.

1910 Kermode, R. C. Mona Vale, Ross, Tasmania.

1918 Knight, C. E. L., B.Sc. Claremont.

1919 Knight, H. W. National Mutual Buildings, Hobart.

1913 Knight, J. C. E. Claremont.

1924 Legge, R. W. Cullenswood, Tasmania.

1919 Lewis, A. N., M.C., LL.M. "Werndee," Augusta road, New Town.

1887 Lewis, Sir N. E., K.C.M.G., M.A., B.C.L., LL.B. Augusta Road, New Town.

Year of Election.

1912 Lindon, L. H. "The Lodge," Park Street, Hobart.

1900 Lines, D. H. E., M.B., Ch.B. Archer Street, New Town.

1921 Listner, W. P., M.A., LL.B. Augusta Road, New Town.

1912 Lord, Clive E., F.L.S. "Cliveden," Sandy Bay.

1921 Lord, Chester. "Mellifont," High Street, Sandy Bay.

1921 Lord, Raymond. "Handroyd," 6 Franklin Street, Hobart.

1924 Lord, Ronald. Derwentwater Avenue, Sandy Bay.

1922 Low, H. M. "The Gables," Pottery Road, New Town.

1893 McAulay, Professor A., M.A. The University, Hobart.

1923 McAulay, A. L., Ph.D. The University, Hobart.

1921 McClinton, Dr. R. 70 St. John Street, Launceston.

1922 Macleod, Mrs. L. H. High Street, Sandy Bay.

1919 Mackay, A. D. 83 Patterson Street, Launceston.

1918 Mansell, A. E. 331 Davey Street, Hobart.

1924 Marsh, James. "Westella," Elizabeth Street, Hobart.

1918 Martin, Brigadier-General W. Launceston.

1921 Masters, A. H. A.M.P. Chambers, Launceston.

1921 Meston, A. L. 115 Canning Street, Launceston.

1909 Millen, Senator J. Roxburgh, Newstead.

1907 Miller, L. S., M.B., Ch.B. 156 Macquarie Street, Hobart.

1921 Miller, R. M. State High School, Launceston.

1911 Montgomery, R. B. "Astor," Macquarie Street, Hobart.

1918 Murdoch, M.L.C., Honourable Thomas. 55 Montpelier Road, Hobart.

1921 Muschamp, Rev. E. Holy Trinity Rectory, Launceston.

1925 Nettlefold, R. Macquarie Street, Hobart.

1924 Newall, A. P. Charles Street, Moonah.

1882 Nicholas, G. C. "Cawood," Ouse.

1918 Nicholls, Sir Herbert, Chief Justice of Tasmania. Pillinger Street, Sandy Bay.

1910 Nicholls, H. M. Department of Agriculture, Hobart.

1921 Nye, P. B., M.Sc., B.M.E. Geological Survey Office, Hobart.

1917 Oldham, N. New Town.

1921 Oldham, W. C. 39 George Street, Launceston.

Year of Election.

1919 Oldmeadow, H. E. R. "Roseneath," Austin's Ferry.
1924 Oliver, H. Lindisfarne.
1922 Overell, Miss Lilian. Holebrook Place, Hobart.
1921 Padman, R. S. 56 St. John Street, Launceston.
1921 Patten, W. H. 59 Cameron Street, Launceston.
1923 Parker, Dr. G. M. Bellerive.
1922 Parker, H. T. "Montana," Bellerive.
1908 Parsons, C. J. 190 Davey Street, Hobart.
1925 Pearse, D. C. "Brown House," c/o P.O., Bellerive.
1923 Pedder, A. Stoke Street, New Town.
1922 Perrin, Miss K. C/o Mrs. F. Tyson, 227 George Street, Launceston.
1902 Piesse, E. L. "Merridale," Sackville Street, Kew, Melbourne.
1910 Pillinger, J. 4 Fitzroy Crescent, Hobart.
1918 Pitt, F. C. K. "Glen Dhu," The Ouse.
1925 Pratt, A. W. Courtney. "Athon," Mount Stuart Road, Hobart.
1925 Propsting, G. L. Earl Street, Sandy Bay.
1923 Purcell, G. A. Clemes College, Hobart.
1921 Reid, A. McIntosh. Geological Survey Office, Hobart.
1922 Reid, A. R. Curator, Beaumaris Zoo, Domain, Hobart.
1925 Reid, Miss M. L. The University, Hobart.
1921 Reid, W. D. Public Buildings, Launceston.
1921 Reynolds, John. Knocklofty Terrace, Hobart.
1925 Robinson, F. G. 42 Regent Street, Sandy Bay.
1884 Rodway, L., C.M.G. 77 Federal Street, Hobart.
1923 Rogers, G. H. B. 204 Davey Street, Hobart.
1921 Rolph, W. R. *Examiner* and *Courier* Office, Launceston.
1913 Ross, Hector. Cambridge, Tasmania.
1922 Sargison, H. Elizabeth-street, Hobart.
1921 Savigny, J. 21 York Street, Launceston.
1896 Scott, R. G., M.B., Ch.M. 172 Macquarie Street, Hobart.
1921 Scott, H. H. Curator, Victoria Museum, Launceston.
1925 Semmens, Rev. B. L. 17 Cedric Street, North Hobart.
1921 Sharland, M. S. R. *The Mercury* Office, Hobart.

Year of Election.

1921 Shields, M.L.C., Honourable Tasman. 13 Patterson Street, Launceston.
1925 Shoobridge, K. Glenora.
1921 Shoobridge, Honourable L. M. "Sunnyside," New Town.
1924 Shoobridge, Rupert. "Fenton Forest," Glenora.
1923 Shoobridge, S. E. C/o Messrs. H. Jones and Co., Hobart.
1923 Simson, Mrs. L. 3 St. George's Square, Launceston.
1917 Slaytor, C. H. Misterton, Doncaster, England.
1924 Smith, Colonel R. P. A.M.P. Society, Hobart.
1921 Smithies, F. 34 Patterson Street, Launceston.
1925 Stackhouse, C. K. R. 55 Patterson Street, Launceston.
1924 Stephens, Crofton. Messrs. Clerk, Walker, Stops, and Stephens, Collins Street, Hobart.
1919 Stevenson, Miss F. "Leith House," New Town.
1920 Swindells, A. W. 2 Patrick Street, Hobart.
1918 Taylor, W. E. Elboden Street, Hobart.
1920 Taylour, W. H. Equitable Buildings, Collins Street, Melbourne.
1922 Thomas, Lieutenant-Colonel L. R., D.S.O. The University, Hobart.
1921 Thomas, P. H. Agricultural Department, Hobart.
1923 Thomas, J. F. 64 Elizabeth Street, Sydney.
1922 Thompson, E. H. Lower Sandy Bay.
1918 Thorold, C. C. Hutchins School, Hobart.
1923 Unwin, E. E., M.Sc. Pendle Hill, Mortimer Avenue, New Town.
1925 Urquhart, M. L. Ashfield Street, Sandy Bay.
1918 Walch, P. B. C. King Street, Sandy Bay.
1925 Walker, Norman. The Hutchins School, Hobart.
1913 Wardman, John. Botanical Gardens, Hobart.
1918 Waterhouse, G. W. Messrs. Ritchie and Parker, Alfred Green and Co., Launceston.
1922 Waterworth, E. N. Poet's Road, West Hobart.
1922 Watson, D. W. "Undine," Glenorchy.
1922 Wayn, Miss A. L. C/o J. Moore-Robinson, Lower Sandy Bay.
1918 Weber, A. F. Lands Department.
1923 Webster, Hugh C. "Greystanes," Lower Sandy Bay.
1923 Wherrett, Miss A. Florence Street, Moonah.
1922 Winch, A. A. "Stornoway," Huon Road, Hobart.
1925 Winch, M. W. Stoke Street, New Town
1901 Wise, H. J. Lambert Avenue, Sandy Bay.
1924 Young, F. M., B.A. Montagu Street, New Town.

ANNUAL REPORT

1925.

The Council and Officers.

The Annual Meeting was held at the Society's Rooms, the Tasmanian Museum, Hobart, on 9th March, 1925.

The following were elected as members of the Council for 1925:—Messrs. W. H. Clemes, W. H. Cummins, Dr. W. L. Crowther, Major L. F. Giblin, Rt. Rev. R. S. Hay, Messrs. J. A. Johnson, A. N. Lewis, L. Rodway, and Dr. Sprott.

During the year eight meetings of the Council were held, and the attendance was as follows:—Mr. Rodway, 8; Mr. Lord, 8; Mr. Clemes, 6; Mr. Johnson, 6; Dr. Crowther, 5; Mr. Lewis, 5; Dr. Sprott, 5; Rt. Rev. R. S. Hay, 4; Major Giblin, 4; Mr. Cummins, 3.

The Council at its first meeting made the following appointments:—

Chairman of Council.—Mr. L. Rodway, C.M.G.

Secretary.—Mr. Clive Lord.

Standing Committee.—Messrs. Rodway, Clemes, Lord, and Major Giblin.

Editor of Papers and Proceedings.—Mr. Clive Lord.

Hon. Treasurer.—Dr. W. L. Crowther.

Trustees of the Tasmanian Museum and Botanical Gardens.—Doctors Crowther and Sprott, Messrs. Clemes, Johnson, Lewis, and Rodway.

Meetings.

During the year eleven ordinary and one special meeting of the Society were held, and were well attended. Details will be found in the Abstract of Proceedings.

Membership.

The membership of the Society shows a slight decrease. This may be traced to the financial depression which the State generally is experiencing at the present time. In any case, a membership of over 200 for such a comparatively small community may well be considered satisfactory, particularly so, as the membership roll has been carefully revised and contains only financial members. The roll at the end of the year showed:—4 Honorary Members, 8 Corresponding Members, 9 Life Members, and 225 Ordinary Members.

Historical Documents.

Last year's report referred to a most valuable collection of Franklin MSS. presented to the Society by Mr. W. F. Rawnsley, and it is the pleasant duty of the Council to place on record a continued interest in the work in which the Society is engaged of acquiring historical documents for its library. The most recent addition has been a series of notes on early Tasmanian history and notes on the Journal of Captain Charles O'Hara Booth prepared by Mr. R. W. Giblin, F.R.G.S.

Publication of Professor McAulay's Papers.

The Council records with great satisfaction that a second instalment of Professor McAulay's Researches on Relativity has been published by the Society in the face of great typographical difficulties, this work being done at the charge of a special fund subscribed by members and others for the purpose.

Library.

Reference was made in last year's report to the congested state of the Library, which makes orderly arrangement impossible, and seriously threatens the practical usefulness of the valuable collection. The position has naturally grown worse with the additions made during the year. Additional space is most urgently required. The Museum trustees are prepared to make available a storeroom in the basement under the present Library as soon as they can obtain funds for at least a temporary structure to house the stores, etc., now occupying the room. It is most earnestly to be hoped that the comparatively small amount required for this purpose will be provided this year.

Centenary of Constitutional Independence.

The Centenary of Constitutional Independence of Tasmania was celebrated by means of a dinner held at the Society's Rooms on the 3rd December, 1925.

Speeches suitable to the occasion were made by several members of the Society and representatives of the Government and other public bodies present.

Further details concerning this function will be found in the Report of the Historical Section.

Obituary.

It is with regret that the Society has to record the death of the following members during the year:—The Honourable J. R. Chapman, Messrs. Robert Gould, Edward Hawson, W. L. May, and in addition the following Corresponding Members:—Professor W. A. Haswell and Mr. J. H. Maiden.

R. M. JOHNSTON MEMORIAL.

The R. M. JOHNSTON MEMORIAL MEDAL.

List of Awards:

1923 Sir T. W. Edgeworth David, K.B.E., C.M.G., B.A., F.R.S., F.G.S.
1925 Professor F. Wood-Jones, M.B., B.S., M.R.C.S., L.R.C.P., D.Sc.

NATIONAL MUSEUM MELBOURNE

BRANCH REPORT

NORTHERN BRANCH.

ANNUAL REPORT FOR 1925.

Owing to the absence of our late Hon. Secretary from the State, no ordinary meetings of the Northern Branch were held until June. Mr. Halligan (Hon. Secretary), having then decided to remain in Sydney, forwarded his resignation, which was accepted with much regret, involving as it did not only the loss of his services as Secretary, but also as an active member of our Branch.

Mr. R. Stewart Padman was elected to fill the position. At the Annual Meeting, held in June, the following were elected members of the Council:—Hon. Tasman Shields, Messrs. H. H. Scott, J. E. Heritage, R. O. Miller, F. Smithies, J. R. Forward, F. J. Heyward, W. D. Reid, and R. S. Padman. At the conclusion of the formal business an illustrated lecture on "Town Planning" was given by Mr. F. J. Heyward, F.R.V.I.A.

On the 20th July Mr. H. H. Scott gave an interesting lantern lecture at the Museum, his subject being "Clouds."

On the 17th August we were favoured with a visit from Mr. J. C. Breaden, one of the members of our parent association. His lecture, "Wild Flowers and Ferns," illustrated by beautiful hand-painted slides, was much appreciated by the large attendance of members and visitors.

Our City Engineer, Mr. G. D. Balsille, on the 2nd December, gave a most interesting lecture on "Water Treatment and Purification." Although our meetings this year have been less in number than usual, the larger attendances at the last several meetings evidence a growing interest which we hope will be maintained next year.

SECTION REPORTS

HISTORICAL AND GEOGRAPHICAL SECTION.

During the past year the Section's activities have been confined to the preparation and presentation of an "historical" night before the October meeting of the Society, and assisting with the arrangements for the dinner with which the Society celebrated the centenary of the State's separation from New South Wales. The historical evening took the form of a series of lecturettes by members of the Section on the Franklin Period in Tasmania (1836-43). Whilst preparing their papers, the members found some new materials and hitherto obscured facts which will be of undoubted value when the history of the State can be again written. Mr. W. F. Dennis Butler (Chairman of the Section) gave an account of the interest Sir John and Lady Franklin took in education and the results of their labours in this field. Mr. A. W. Courtney Pratt read a descriptive paper on the life and character of Franklin, whilst an instructive paper on the administrative difficulties of the times was read by Mr. G. W. R. Ife. The explorations by land and sea of the Franklins were described by Mr. Clive Lord, F.L.S. Mr. Lord made special reference to the assistance given by the Franklins to scientific men as, R. C. Gunn, Joseph Milligan, and John Gould. He also pointed out that the Franklin MSS. in the possession of the Society contained some valuable facts and descriptions of Gould's work in Tasmania which were worthy of further investigation. This evening is the fourth given by the Section, and it is hoped that it will be possible to prepare an evening on the Denison Period (1847-55) next year.

It was largely through the efforts of the Section that any recognition of the completion of the century of Tasmania's separation from New South Wales was made in the State whatsoever. As a result, a dinner was held by the Society in its rooms on the evening of the 3rd December, 1925. Unfortunately, His Excellency the Governor (Sir James O'Grady, K.C.M.G.) was unable to attend owing to the death of the Queen Mother. His Excellency sent the following communication, which was read at the dinner:—

> Had circumstances permitted, I would have been with you at the dinner to commemorate the Centenary of Tasmania's Independence. I was, as you know, hope-

ful that the dinner would have taken place at Government House, but the death of our beloved Queen Mother made that impossible. Nevertheless, I feel I ought to write how glad I am, in the regrettable circumstances, that the Royal Society of Tasmania have resolved even in an abbreviated way to celebrate the occasion of our hundredth year of independence as a Sovereign State. I am sure His Gracious Majesty the King would agree that even midst our sorrow, no matter in how simple a manner, this epoch in our island history should be celebrated.

One hundred years ago the fructification of our liberties as a British community became a fact. From that time onward those liberties have grown broad based upon the people's will, until we reached the full manhood of a Sovereign State. In achieving this position surely the mind of our people when considering this centenary of creation will pause and give thought to the work of the pioneers who made this island State habitable for their sons and daughters, and have given to us richness of life, and, indeed, have made of the State, in modern, social, and intellectual considerations, no small partner in the evolution of the Empire to the place it now occupies in the world's community.

Since I have been in Tasmania I may, perhaps, have unduly stressed the relativity in importance of small as against large States, emphasising that in the mosaic of Empire a place is not to be judged by mere area.

Your celebration on December 3 will, I am sure, add more effectively to that idea—if it is worth anything—but will, anyway, pay to the pioneers their just tribute of praise and cement more securely, if need be, the fabric of Empire of which we are so reasonably proud. Trusting that you will have a successful gathering, and again regretting it is not possible to be with you. Yours sincerely, James O'Grady, Governor.

The Chairman of the Section in proposing the principal toast, "The Constitutional Independence of Tasmania," gave a résumé of the events which led up to separation from the Mother Colony. He dwelt on the attitude of the various Sydney Governors towards the young and growing colony, and showed how the first system of Government became an obstruction in the path of progress. Public opinion in the colony expressed itself, and a little later the Home Author-

ities saw fit to make the change. Response was made by a representative of the Government (Mr. R. Cosgrove, M.H.A.) and the leader of the Opposition, Hon. J. C. McPhee, M.H.A.

The Chairman of the Society (Mr. L. Rodway, C.M.G.) proposed a toast to "Historical Studies," which was responded to by Dr. W. L. Crowther, who emphasised the peculiar interest in the study of Tasmanian history and the necessity for its advancement.

The scope of the Historical Section is limited owing to the pressure of business on all its members. Nevertheless it seeks the co-operation of all members of the Royal Society in its search into the Past and placing the facts gleaned on record for the benefit of the community.

JOHN REYNOLDS,
Hon. Secretary.

EDUCATION SECTION.

The President was Mr. G. H. Huxley, and the Secretary Mr. H. T. Parker. Twelve members were enrolled during the year. Meetings were held monthly, the following subjects being dealt with:—

31st March.—Business Meeting.

21st April.—"Vocational Training in the Elementary Schools." By Mr. G. H. Huxley.

15th May.—"The Emotional Aspect of Education." By Mr. H. T. Parker.

16th June.—"Report on Rural Education in Denmark made by Director of Education in Victoria." By Mr. T. W. Blaikie.

28th July.—"The Tragedy of the English Public Schools." By Major L. F. Giblin.

18th August.—"The Cultural Aspect of Vocational Training." By Mr. L. Dechaineux.

15th September.—"Sex Instruction." By Mr. E. E. Unwin.

21st October.—"Some Aids to Character Training in Secondary Schools." By Mr. Walker.

H. T. PARKER,
Hon. Secretary.

THE ROYAL SOCIETY OF TASMANIA.

RECEIPTS AND EXPENDITURE, 1925. GENERAL FUND.

RECEIPTS.

	£	s.	d.
Balance brought forward	22	13	1
Government Grant	100	0	0
Subscriptions	206	17	0
Sale of Tickets, etc.	3	11	10
Contributions re Centenary Dinner (part)	25	2	0
Rent of Room	13	10	0
Donations to McAulay Fund	10	0	0
Refund from M.A.M. Fund	1	19	0
	£383	12	11

W. L. CROWTHER,
Hon. Treasurer

EXPENDITURE.

	£	s.	d.	£	s.	d.
Salaries				45	1	0
Paper and Proceedings—						
1924 (part)	94	1	8			
1925 (part)	111	8	2			
				205	9	10
Meetings, etc.				49	6	8
Library				16	18	11
Light and Fuel				3	16	6
Petty Cash and Postages				12	0	0
Northern Branch				10	10	0
Miscellaneous				6	3	0
Expenses re Centenary Celebrations (part)				28	16	0
Advance to M.A.M. Fund				2	14	0
Balance				2	17	0
				£383	12	11

CLIVE LORD,
Secretary.

I have compared the Receipt Book, Vouchers, and Bank Book with items particularised in the Cash Book and and found them to be correct.

29/1/26.

R. A. BLACK,
Hon. Auditor.

MORTON ALLPORT MEMORIAL FUND.

RECEIPTS.	£	s.	d.	EXPENDITURE.	£	s.	d.
Revenue, 1925	9	15	0	Part Cost Mathews's "Birds of Australia"	10	10	6
Loan from General Fund	2	14	0	Refund of Loan to General Fund	1	19	0
	£12	9	0		£12	9	0

W. L. CROWTHER,
Hon. Treasurer.

CLIVE LORD,
Secretary.

I have compared the Receipt Book, Vouchers, and Bank Book with the items particularised in the Cash Book found them to be correct.

29/1/26.

R. A. BLACK,
Hon. Auditor

R. M. JOHNSTON MEMORIAL FUND.

RECEIPTS.	£	s.	d.	EXPENDITURE.	£	s.	d.
Balance Brought Forward	16	2	10	Sollas's "Ancient Hunters"	1	10	0
Revenue, 1925	10	19	0	Balance	25	11	10
	£27	1	10		£27	1	10

W. L. CROWTHER,
Hon. Treasurer.

CLIVE LORD,
Secretary.

I have compared the Receipt Book, Vouchers, and Bank Book with items particularised in the Cash Book and found them to be correct.

29/1/26.

R. A. BLACK,
Hon. Auditor,

NORTHERN BRANCH.

ANNUAL FINANCIAL STATEMENT FOR THE YEAR ENDING 31st DECEMBER, 1925.

	£	s.	d.		£	s.	d.
Balance on 31st December, 1924	18	8	1	Advertising	2	7	0
Interest	0	15	4	Printing	2	10	6
Share of Subscriptions	10	10	0	Postages	0	14	6
				Travelling Expenses	2	7	6
				Balance in Bank	21	13	11
	£29	13	5		£29	13	5

R. STEWART PADMAN,
Hon. Secretary and Treasurer.

Compiled from the books and accounts of the Royal Society of Tasmania (Northern Branch), and certified to be in accordance therewith,

J. E. HERITAGE,
Hon. Auditor.

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APPENDIX

FRANKLIN PAPERS.

As mentioned in the Annual Report, 1924 (p. 155), Mr. W. F. Rawnsley presented to the Society a valuable collection of Franklin MSS. As circumstances permit, certain extracts will be published. The following account of an attempted visit to Port Davey is taken from Lady Franklin's Diary.

FRANKLIN PAPERS.—I.

Extracts From Lady Jane Franklin's Diary.

EXCURSION TO PORT DAVEY AND MACQUARIE HARBOUR, DECEMBER, 1838.

(Excursion Stopped At Recherche Bay.)

This excursion, or at least a visit to Port Davey, was first suggested to me by hearing Captain King say he wanted to go thither in search of Huon Pine. To this was added another motive, that of laying down S.W. Cape, whose precise position is disputed by different navigators. In combination with Mr. Gould I determined, if possible, not only to go to Port Davey, but to visit Macquarie Harbour on the Western coast, where a penal settlement was made, and after some years abandoned in the time of Col. Arthur. Since then it has been occasionally visited by vessels for wood, but its difficult access, there being a bar across the entrance of the harbour which in winter weather it is sometimes impossible to enter for days together, and its state of utter desertion make always a matter of some little risk and of diminished interest. As the only harbour, however, on the Western coast, I was very anxious to see it, and Mr. Kelly had been invited and engaged to accompany us as our pilot. This was some weeks ago, when we had thought of embarking, but were prevented by the weather.

On the present occasion, he was prevented by business from accompanying us, but recommended Mr. Bruce, of Research Bay, as a pilot quite as competent as himself to take us in. It was decided, however, that Mr. Lucas, a veteran pilot now residing on his farm near Mt. Louis,

should be the man, and a signal was made to him accordingly to hold himself in readiness. Mr. Frankland, Miss Barnett, and Mr. Lillie, and Mrs. Gould had all at one time wished or intended to be of the party. Various causes prevented them, so that at last we were reduced to 6. Myself and Elinor, Captain and Mrs. King, Mr. Gould, and Mr. Gunn. To these were added, besides the Pilot, servants, viz., the Snatchalls, and a baker from our home establishment, Mr. Gunn's assistant, and a servant of Mr. Gunn's. We were in the 3rd quarter of the moon and the weather, after some rain which had succeeded several sultry days, was beautiful. The *Tamar*, in which we were to enter Macquarie Harbour (the Schooner drawing too much water for the purpose), had been already dispatched to Port Davey, where we were to make the exchange, carrying the bulk of our provisions, which was calculated for an emergency of 6 weeks on board.

A light breeze brought us to the entrance of D'Entrecasteaux's Channel, about 9 o'clock on Tuesday morning, the 11th, when Captain Booth, who was making his way to Port Arthur with his bride in the *Vansittart*, came on board. Not being ready to see him I sent him a message by Elinor to beg him to get made for me at Port Arthur a light chair on poles such as we have been carried about in on Tasman's Peninsula, with the idea that it might be useful to me in our contemplated journey to the New Country. I also wrote by the *Vansittart* a few lines to Sir John.

About 2 o'clock, when within about 4 miles of Green Island, for which we were tacking, Mr. Gould went off in a boat with the hope of reaching it before us, and of finding some penguin's eggs which he is much in want off. He had landed on the island before and killed penguins, quails, ducks, etc. On this occasion he did not succeed in finding any penguin's eggs, but came back with a live penguin, and with the eggs of various gulls. Some of these were too hard to be blown, in which case he cut with the point of a penknife or of a small knife adapted for the purpose, an oval-shaped piece of the shell out of the side, emptied the egg, and replaced the shell.

A fine breeze rising about 5 o'clock carried us past Southport, but died away at sunset. When it rose again it was unfavourable from the S.W. A bank of dark clouds over the land obscured the sight of it, but afterwards rose and spread over the sky. We had a great deal of motion

through the night and at an early hour the following morning, Wednesday, much commotion took place in my cabin, owing to my heavy table breaking away from its lashings and the filtering machine on the drawers coming down and pouring its contents over all the books and other matters on the floor. Snatchall came to my assistance, but much out of sorts, declaring she would never come again. We anchored about 7 in the morning in Research Bay. I was not very well and suffered slightly from the toothache. The *Tamar* had come in the evening before, the weather being equally unfavourable for her proceeding to Port Davey. Mr. Gould went off in the morning to the Acteon Islands, which are about a mile distant from each other and at the distance of about 3½ or 4½ miles from Research Bay. The soil of them is sandy and much covered with scrub. He procured there 2 species of parrots he had not yet taken, an albatross, teal, gulls, and the eggs of the latter. Mr. Gunn and Captain King went up the northern division of the bay, called by the French, its first discoverers, Port du Nord, and ascended a little way the river which enters it and since called D'Entrecasteaux's River. After dinner Mrs. King, Elinor, and I were rowed to the same point under the direction of Captain King and Mr. Gunn. I was much struck with the bold and singularly shaped mountains which rise above the dense woods on the W. side of the bay. Between these and the water there appears to be a level tract of forest. On the N. side of the bay, a promontory forms a sort of inner bay which is familiarly known by the name of the Pigsty. On this point, a whaleboat, going down to Port Davey, had bivouacked the night before and was now away fishing, being detained by the same cause as ourselves. There is some shoal water in this pigsty but which may be avoided by keeping in the Channel. The mouth of D'Entrecasteaux's River is divided by a flat woody island, like that in Fleurieu River at Port Cygnet. The passage which presents itself on the r. seemed the only one fitted for the boat. We landed on its bank to collect the beautiful *Blandfordia nobilis**, whose branches of scarlet tubes, lined at their scalloped edges with yellow, show magnificently amongst the more delicate plants, generally white ones, which conceal the poorness of this white clayey soil. There is but this single species on V.D.L. but in N.S.W. is another, double the size, called *grandiflora*. Whilst thus engaged Captain King was in chase in his boat

* [=*Blandfordia marginata*.]

of a poor, solitary duck, which dived at the moment when, believing it to be the same as one he had wounded in the morning, he thought to have caught it. Mr. Gould, hearing the circumstances, thought she was more cunning than her pursuer, and was leading him away from her nest.

We were informed that a barque, supposed to be from England, was seen going up Storm Bay to-day towards Hobarton. The next day, Thursday 13th, 2 other vessels were reported as having been seen on their passage to Hobarton. It made me almost regret our own absence. Messrs. Gould and Gunn set off to-day to the head of the bay to a plain, which appears to run up many miles into the country the hill called South Cape, which presents towards the bay a steep and particularly denuded surface. Mr. Gunn ascended this hill which he thinks is about 800 feet high. It is of sandstone and has some veins of coal, but of a very indifferent kind. He saw a considerable extent of coast and the Mewstone rock from its summit. Mr. Gould expected a rich harvest from the appearance of the plain, both as respects quadrupeds and birds, but it was remarkably destitute. He brought back, however, the nest of an emu wren, and a parrot which he had not killed before. The plain was as poor in shrubs and plants as in living instances. The soil was wet, poor, and boggy. The plants were of stunted growth and there was no scrub. Mr. Gunn, however, found in some more favoured spots 2 plants which were new to him. Both were of the *Proteacea* family—the one, a beautiful shrub about 5 feet high growing very erect with clusters of white flowers, the other of the genus *Lomacia*, which comes next to the waratah in that family—all the *Proteacea*, Mr. G. told me, have no properties whatever and make even but bad fire-wood.

Recherche Bay has a peculiar interest as being the first harbour in which D'Entrecasteaux landed nearly 50 years ago. The French are said to have planted a garden here, and to have left inscriptions engraved on copper on some of the trees—Lucas, to whom we referred for local information, knew nothing of the garden, but 2 trees, he said, blown down by the wind, or uprooted by the beaking away of the bank, were lying on the beach on the S. which still bore the marks of the places where the plates had been inscribed, though they themselves had been removed. We landed on the S. shore, guided by Lucas, in search of these trees, and after passing a little way along a footpath in the fern which the whalers have traced from one station

to another, came down on the white sandy shore and walked on till the 2 dried and ash-cold. old gum trees in question lay across our path side by side, presenting their decaying roots to the bank from which by violence they had been long divided. Lucas saw them in this state 6 or 7 and 20 years ago, when he first visited this spot. At that time one of the trees retained a portion of the copper-plate inscription which has since disappeared, probably like the rest carried off by the natives. The other tree contains an oblong hollowed space, about 3 fingers long and somewhat less broad, and of sufficient depth to have contained papers which it is supposed were inserted in it and closed down by the plate. The iron nails which fastened down the plate remained round the outer edge of the excavation—worn away and rusted. I carried off one of them, as well as one of two circular knobs carved in a lower part of the trunk near the root—some more pieces were afterwards subtracted from the decaying trunks by the gentlemen on a subsequent visit, the excavated box being left by us all uninjured.

Proceeding from hence along the shore towards the head of the bay, our olfactory nerves were sorely disturbed by the effluvia from some putrid whale carcases which were lying on the sand, and which were borne by the wind right against us. Thronging past these nuisances we reflected that for the comfort of future generations, the last of these whales would probably have deserted these shores before Mr. Frankland's bathing place of Ramsgate shall have built its lodging houses and bathing machines. This reserved township is at the head of the bay on the plain before mentioned, and on the banks of a small fresh water stream which comes down alongside of it. Our walk extended no farther than the right bank of the stream which we could not cross without wetting our feet, though it is much obstructed by sand and not navigable at least in its present state by boats. A fine lofty hedge of the Babialla, whose berries or seeds were roasted and eaten by the natives, borders the white shore in an even line for some distance eastward of the river, its rich and glowing colouring, though not in flower, forming a beautiful contrast to the taller line of the forest trees behind whose trunks it concealed. Returning to our boat, we crept along the other or northern side of the bay, where the sandy beach presents itself only in small patches slightly embayed between the loose dark rocks, which form the general outline and from which the forest immediately rises.

This side of the bay is more indented than the opposite one, and presents a double cove divided by a point which has a melancholy interest as being the spot on which the convict mutineers of the *Cyprus*, going to Macquarie Harbour landed Lieutenant Crowe, who had the military command of them, with his wife, who nearly perished in the woods, before assistance came to them.*

The first of these coves which we came to, or the most western, is much obstructed at its entrance along the W. side by sea-weed. A fine streamlet of water is seen on the beach, pointed out to us by Lucas. I asked him if the cove had any name, and being answered in the negative, observed to Captain King that I thought it deserved one, and that it could hardly have a better than Lucas; Captain King in consequence communicated to him my wish that it might henceforth be called *Lucas Cove*, upon which the old Pilot raised his cap from his head and looked infinitely pleased. He merited this compliment from me as having, when a boy, a few years younger, I believe, than Sir John, suffered shipwreck with him in the *Porpoise* on the Coral Reef. Poor Lucas is rather an interesting person when once one can succeed in overcoming the disgust which his first appearance excites. His face has been shattered and greatly disfigured by the contents of a pistol with which in a moment of passionate despair, being disappointed in love, he endeavoured to blow out his brains. His father was an officer in the 108th N.S.W. Regiment stationed in Norfolk Island where Lucas was born.

I was speaking of the coves on the N. side of the bay. The 2nd contains a whaling station of Messrs. Kerr and Alexander. The shears at the farther end of against which the carcase of the whale is erected to be cut up in pieces, indicates that there is deep water along the edges. We returned on board the schooner for dinner. As we were sitting round the table afterwards, a smell was wafted in which convinced Captain King and myself, who observed it at the same moment, that some change must have taken place in the wind, and immediately all hands were at work on deck to enable us to get under weigh. The *Tamar*, not waiting for our signal, was already making similar preparation. The breeze was from the Northward. Lucas seemed doubtful about it, the setting sun behind the hills,

*On reconsideration, I believe the landing place in question was the W. point of the most western of the coves which I have called Lucas Cove.

though not so red as when he had called our attention to it before as a sign of unfavourable weather, was not propitious, but he did not oppose our starting since we could easily return if the wind did not hold. As we passed Bruce's pilot station, he came off to us in a boat, remained a short time with us, and gave us more hope than Lucas of the weather improving. One of his boatmen was called on deck by Captain King to be examined as to a tale he had told the day before of a boat capsizing as it rounded S. Cape. He was on the look-out station, near this spot, when he saw the accident. He saw one man go over into the boat to leeward, and another *jump out to windward*, he climbed a tree to see better, but when he looked again, could find no trace of what had happened. He ran along the shore to his master, Bruce, when he arrived apparently much alarmed and said he had been pursued in his way by a black snake. Bruce and Lucas walked along the shore in search of an oar or some indication of the accident, but nothing was to be found, and this negative circumstance, together with the man jumping to windward, and even the black snake convinced Captain King it was all a story of his own invention. I was present when the man was questioned. He was minute in his details, and never contradicted himself, but the former property of liars amongst his class is, I am told, a fact of notorious generality.

I was struck as we moved along with the dense gloom and blackness of the woods as they rose immediately from the shore upon an outer base of dark-hued rocks. Over these the mountains behind Research Bay presented a noble and singular outline. I thought the French writers who expatiate so much on the terrible and severe aspect of nature in these Austral regions were not so much in the wrong. We came along the headland called S.E. Cape, or which rather, I believe, has no name at all though it is the most S. point of the island and had an extent of coast before us extending to the promontory called the Whalers' Head. We were not destined, however, to make any further progress. The sails began to shake, the wind had veered round again to the S.W., and about 9 o'clock it was determined to turn about and resume our former anchorage. A gun was fired to direct the *Tamar* also, and after a very rough passage we took up our anchorage again in Research Bay about midnight. The weather was so bad the next day, Friday 14th, that even the gentlemen could not go on shore, it not being deemed prudent to take out a boat. To me

it was a matter of indifference for I was suffering much from toothache, and kept my cabin and almost my bed the whole day. On Saturday I suffered still more in the head and under these circumstances could scarcely help rejoicing that there was nothing to do or to see from the enjoyment of which I should have been excluded. In the forenoon I heard rather a strange noise on deck but took no notice of it as the vessel was full of noises. Presently, however, Captain King desired to see me. I was in bed, but admitted him. It was to tell me we had broken our windlass, so that we could neither lie here in safety nor proceed with our voyage. At first he seemed to think of returning to Hobarton, but presently resolved to go to Port Arthur where we should arrive in four hours' time at the rate of 10 miles an hour before the gale. At last, however, and much more to my satisfaction, I found that the *Tamar's* 2 carpenters, in addition to a single one of our own, could repair the mischief for us on the spot in 2 days' time, there being good seasoned timber to hand which would answer the purpose. This being decided upon, Bruce volunteered to go up in his boat to Hobarton (where his wife is now staying) and to take letters to Sir John. I rejoiced in the opportunity, and a packet consisting of a letter from me, one from Elinor to Sophy, and one from Mr. Gould to his wife, was soon dispatched. It was calculated that Bruce would return before we should be ready to start and that if any vessel wanting to enter the channel in his absence should be seen, Lucas would take his place as Pilot. The gentn. went on shore at night with a seine, lighted a fire and caught some fish. I was obliged to keep my room the whole of this day and the whole of the next also. The next was Sunday and Captain King read prayers and a sermon in the cabin to the cabin party.

We were at this time again in motion for Port Davey, a light favourable breeze having sprung up about 10 o'clock, which Captain King thought it well to take advantage of. Leaving the *Tamar* behind to bring on the letters which Bruce might be entrusted with. Our attempt this time was of shorter duration than before—a calm came on, then the wind returned to its old quarter and by 1 or 2 we had returned to our last anchorage which since the accident to the windless was in a more inland and sheltered position. I received a second visit from Captain King in bed, to inform myself of all these movements, and was again not sorry that we were at rest.

Monday 17*th*. It blew very hard, but not so much so as to prevent Messrs. Gould and Gunn going on shore. They visited the stream called Catamaran River in the Port du Nord. I felt better to-day and spent some time in the cabin, but was not able to eat there. Had the weather been fair to-day, Bruce might have returned by night but it blew so directly in his teeth that no hope of his arrival existed while the wind lasted with this violence. We had a new moon on Sunday last, and Lucas said the present bad weather might still last several days. We swung about at anchor during the night and woke to the tune of the same piping wind on.

Tuesday the 18*th*. The gentlemen visited the Catamaran River, round Rocky Point in the central of the 3 divisions into which Research Bay may be said to be divided. It is the most considerable stream which enters the bay, being much wider than D'Entrecasteaux River. At the entrance on the r. is a heap of rocks insulated at high tide with an old gum tree growing on the summit. It being now unfortunately low water and the boat not a very lightsome one, we made but little way and after grounding several times, turned about again. The river was about 120 yards wide at this spot. Mr. Gunn, who had been some way further, landed on the l. bank of the stream and found a rich soil, likely, however, from its lowness, to be overflowed. Mr. Frankland, in his map, has given the name of Catamaran River to a small creek considerably further to the North, or rather has marked it in a place where no river exists at all. There can be no doubt, however, that he meant the stream at the locality I am now speaking of. The greater part of the W. shore of this division of Research Bay was not surveyed by the French, probably on account of the shoal water under the banks on that side. As we looked at the beautiful range of mountains on this side we thought it was a pity they bore no name and determined to call them the Research Range, and as one of them stands out isolated from the rest and has a striking and noble appearance, we, on this account, and in compliment to Captain and Mrs. King, declared it should be King Mountain or Mount King.

Our next object was to land on Observatory Point on the E, side of the entrance to the Port du Sud (D'Entrecasteaux's anchorage) and where the astronomers of the expedition made their observations. By the emptied oyster shells, the cleared and trodden grass, the remains of cinders and

wattled wind screens it appears to be now resorted to as a place for bivouacking, as was lately the case with a boat going to Port Davey. Having remained a short time here we re-embarked, and coasted along a little further until we came to a beach which is covered with petrifactions of wood, many of which we collected. The rocks along this bay are covered with muscles. There are also oysters, but less numerous. A dish of muscles had been much admired to-day at the breakfast table, and a few oysters were discovered here, opened, and eaten on the spot. We now directed our course to the supposed locality of the garden planted by La Haye, botanical gardener to the French expedition. On looking at the map I find it cannot be far beyond the beach of petrifactions, but overshooting our mark we turned a point which imbays this part of the shore and proceeded to within a little distance of the mouth of a creek in a nook formed by another projection which is at the entrance of D'Entrecasteaux River. Crossing this creek we were led by Mr. Gunn through some thick cutting grass to a small ascent where, under the shade of 2 gum trees, a semicircular patch of sloping ground appears to have been entrenched from the cutting-grass bottom below, and Mr. Gunn thinks to have been once dug. The soil was of the most wretched description, white clay mixed with stones, and produced nothing but a little stunted and scanty fern and some few flowers amongst which was the beautiful Blandfordia which seems to bloom in worthless soils.* Nothing like a European plant or vegetable was to be seen. We were not at all satisfied with the French garden, but till we re-examined M. Bontemps-Beaupré's chart did not question its identity, finding no better place to select. On looking again at the chart, however, we saw we had gone too much to the North and that it was in another place we ought to have sought for it. Mr. Gunn accordingly wished to start the following morning at 6 in a second search for it. As we returned to our anchorage this evening we saw a schooner called the *Prince of Denmark*, which had been lying here since Sunday last, with her sails filled, coming out of the Bay in order to go up to Hobarton. (She is a vessel belonging to Messrs. Kelly and Hewitt, and hired on the present occasion by Mr. Stanley, of Launceston, to bring away some oil which had been deposited there and which is going to England in the *Augusta Jessie*.) We had informed ourselves of the probable

*Mr. Gunn found an orange variety of it, equally beautiful with the scarlet.

hour of her departure before we set off on our afternoon's excursion and felt assured we should have the whole evening to write letters in for Hobarton. Mr. Gould, who was on board the *Eliza* on our return, had witnessed her preparations for departure and made an ineffectual effort to detain her half an hour. As he could not prevail, he refrained from sending any letter himself to Mrs. Gould, out of kindness and delicacy to me who could not do the same to Sir John. Mr. Gunn's ready written letter to his brother was also left behind. The weather was much calmer this evening, but no Bruce arrived. Captain King called out to the master of the vessel as we passed under her stern to desire him to let the Lieutenant-Governor know he was not yet returned.

Thursday the 20th. We again entered the Catamaran River and pursued it for about a quarter of a mile up at high tide, when our further progress was arrested by fallen trees or snags. Landing here on the left bank of the stream, we carried away by the roots some native laurel, fern trees, and ferns, and gathered boughs of the beautiful native myrtle (really a beech, *Fagus cunninghamii*) which abounds here and of the celery-topped pine (*Podocarpus asplinifolium*)* (from its fruit being sessile, having a small foot-stalk). We have not obtained any wattle trees in the environs of Research Bay, the myrtle and the fern-tree indicate a rich and good soil. As we returned to the schooner after this short excursion we saw the *Vansittart* coming in to bring the monthly stores to Bruce's station, as well as to Bruny lighthouse. On waking in the morning I had found a packet of letters and newspapers from Sir John brought by Bruce, who reached town last Saturday. My packet was taken up to Sir John at 11 o'clock at night when he was asleep, but he was waked to read them, and Bruce set off on his return the next day at 12. The immediate return of the *Vansittart* enabled me to return very prompt answers to Sir John's letters. I was glad to find that he expressed no impatient nor unnecessary apprehensions about us. One of the ships which had been seen going up Storm Bay was the *Thebe*, from London, which brought no letters except the duplicate from the wine-merchant with the wine itself. The news sent me by Sir John is noted elsewhere. I wrote him a long letter of suggestions and recommendations in reply to his letter, endeavoured to make the best of our unfortunate detention, and to give every hope I could of the

*[Celery-top Pine, *Phyllocladus rhomboidales.*]

future. I did not tell him that Mr. Gould was worn out by our reverses, regretted the loss of time, and this very afternoon had been declaring with many apologies that he must go back in the *Vansittart*. His good humour under his prolonged disappointment had never failed, but his time was precious to him. When he came to V.D.L. he intended to stop only a month. How should he get through his work if he went on in this way? Mr. Gould was to my very great regret in this disposition when Mr. Gunn, Elinor, and I embarked again in the evening to visit the shores of that portion of the northern part of Research Bay where La Haye's garden was planted, and where Captain King had discovered signs of coal. A specimen of this, taken from the bank, together with our petrifactions, some of which were of a large size, and other roots were dispatched to town by the *Vansittart*. Mr. Gunn's researches for the garden (which he had made in the morning) were entirely without success, and he did not recommend us to go to the same locality on account of the difficulty of getting through the thick cutting-grass which was 6 feet high. I took the opportunity being alone with him of consulting him on some points in Sir John's letter, of asking his opinion of several individuals and he answered me with his accustomed candour. On our return to the schooner we found Mr. Gould no longer firm in his former determination to depart immediately, and on my telling him he must give me his hand in pledge that he would stay here and work longer if necessary, he, after a little hesitation, consented. As a little compensation I begged Captain King to let us remove either to Bruny, or to Muscle Bay, which would make very little difference when once the wind set in fair, and it was accordingly settled that at daylight we should sail for Muscle Bay.

We anchored here about 7 o'clock on Friday morning the 21st at the midsummer, or longest day of this country. The same S.W. wind and cold and cloudy weather continued. Mr. Smith came on board to breakfast, after which he and Mr. Gould went off to pursue the inlet at the other end of the bay to its extremity. The rest of us followed some time after in another boat, and passing Pelican Island, on which Nanny, the goat, had been previously landed for green-food, and exercise, we advanced towards the point which at the farther end of the bay narrows the entrance to the inner waters. Widening immediately after the passage of this narrow point, the inlet presents a fine basin, bounded with rather steep, but not lofty, banks with trees of moderate

size and density. It was in this basin, and not 200 yards from the shore on the right hand, that poor Burnett's boat capsized and himself met with a watery grave. It happened singularly enough; young Hurburgh, Burnett's companion, and then master of the *Vansittart*, was now steering our boat, having been removed into the command of the *Eliza*, in the room of his elder brother who is going to England on two years' leave of absence in command of the *Wallaby* (a colonial vessel, originally called the *Fanny*, built at Port Arthur, and purchased on speculation by Messrs Willit and Garrett, for sale in England.) Proceeding a little further and rounding a small point on the r. we passed in succession two coves, neither of which appeared to receive any fresh water. On the l. a projecting headland appeared to us to be an island and to have a passage on the other or l. side, as well as on this. But in this we were mistaken, the water, however, forms a bay or inlet under it. The banks were of only moderate height but rose at once from the water rather scantily wooded, so that the sky and the back mountains were seen through them. If similar in soil as we suspected it to be to the banks on the r., the land is of a very poor description. The beautiful Blandfordia, which we were near enough to admire on our right bank sufficiently indicated the poverty of the soil. A third and deeper cove or bay succeeds to the former ones and here the promontory ends, on the l. a broad and deep inlet is seen on that side, admitting a stream which appears to come down from the noble group of mountains at the back. Mount King and Snowridge were the highest of them and though seen in an altered position were easily recognisable. Snowridge, we thought, deserved its name from its preserving patches of snow on this, the longest summer's day. The inlet on the left is the most extensive body of water and receives, as we were afterwards informed by Mr. Smith and Mr. Gunn, a very pretty fresh water stream. We, however, continued our course in a direct line towards the head of the water before us, and which terminates in a rounded beach bordered by a hedge of flowering tea trees with a wall of lofty foliage behind it, leaving a dark gap, however, in the middle, where a small creek enters the bay. The hills rising behind this foreground complete a picture of great beauty. It was low water and the boat could not get up to the creek and scarcely was able to frighten away the swans and sea fowl which thickly studded the wet sands left by the retiring tide. We saw 4 pelicans standing in a procession line and looking like cari-

catures of something, I know not what, and innumerable gulls, duck, gannets, etc. We had passed several black swans which suffered us to approach so close that they were taken for *moulters*, which losing their feathers at midsummer cannot fly and are easily taken without firing a shot. This was not the case, however, for the boat nearing them a little more, they rose hissing in the air and moved off.

On our return to the schooner, we were landed on Pelican Island where we found Nanny and Mr. Smith's 4 sheep, the remains of the 12 which I think were here when we visited Muscle Bay before. The soil of the little island is sandy, but rather black looking. It contains probably 3 or 4 acres of land. Some old gum trees, almost denuded of foliage, rise to a considerable height on it. Mr. Smith placed two pair of rabbits on it, which have multiplied to 26. We started several of the young ones and it was a ridiculous thing to see Captain King amongst the rest hallowing and skipping after them. One poor young thing was caught by hand, but though Mr. Smith had begged the gentlemen to kill some if they pleased, it was released. A minor islet called Little Pelican is scarcely separated from the other at low tide.

We had to wait till a late hour for dinner, not wishing to sit down without Mr. Gould and Mr. Smith. I found the latter grown fatter since I saw him last, and equally amiable and contented. He seemed satisfied with his position and so does his wife, who occupies herself with botany, or at least with collecting and preserving flowers. He had almost 8 or 9 police cases brought before him this last whaling season. The punishment is chiefly fines, extending from a sum not less than £2 nor above £20. Their employers are subject to fines not less than £10 nor above £100. He mentioned that one case brought up to him was by a headman or manager who brought up 2 men to be punished because they were cowards, when the whale was seen, they refused to row up to it. Mr. Smith could not enter into a charge such as this. He believes the existence of a police station here has diminished, as it would be expected it might have done, the number of offences committed. They are sent up to Hobarton for punishment on the treadwheel when required. It was suggested that if there were a whalebone breaking establishment here the men under punishment might be more usefully employed.

APPENDIX.

Researches in Relativity

--The Basis of the Physical World as indicated by carrying as far as possible the Tenets of Relativity.

BY

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Professor of Mathematics, University of Tasmania.

(Read 15th April, 1925)

NOTE.—Paging and numbering of Articles continued from "Researches in Relativity, I.," P. and P., 1924, Appendix.

Additional Errata

In the first paper an unfortunate error of sign occurred early and has necessitated the corrections below. ${}^c\lambda$ and ${}^c\omega$ were correctly defined, the first in the last line of page 1 and the second in equation (2) on page 2, but the minus sign is incorrectly put before ${}^c\omega$ on line 24 of page 3; and the following corrigenda are the result:-

Page 3, line 24 For $-{}^c\omega$, read ${}^c\omega$

Page 4, equation (7) For $V_2\Delta^c\lambda$, read $-V_2\Delta^c\lambda$

Page 4, equation (10) For $-{}^l\kappa$, read $+{}^l\kappa$

Page 5, equation (14) Delete first minus sign.

Page 6, line 17 For

$${}^c\lambda V_0\Delta^l\lambda + V_1{}^l\lambda\,{}^c\omega = {}^c\lambda V_0\Delta^l\lambda + V_1{}^l\lambda V_2\Delta^c\lambda,$$

read

$$-{}^c\lambda V_0\Delta^l\lambda + V_1{}^l\lambda\,{}^c\omega = -{}^c\lambda V_0\Delta^l\lambda - V_1{}^l\lambda V_2\Delta^c\lambda$$

Page 6, equation (15) For $V_1{}^l\lambda\,{}^c\omega$ read $-V_1{}^l\lambda\,{}^c\omega$

I hope this completes the list of necessary corrections.

RESEARCHES IN RELATIVITY. II.

(Art.7 - 12)

THE BASIS OF THE PHYSICAL WORLD AS INDICATED BY CARRYING AS FAR AS POSSIBLE THE TENETS OF RELATIVITY

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Art.7. On the kind of invariantive relations to be expected in the physical manifold.

A summary of the present paper will be found in the opening paragraphs of Art. 12 below.

In the last paragraph but one of Art. 6 it was stated that researches already in existence were to occupy our attention. But the writer has found much of interest to add to the foundations. The present paper will be occupied with these additions.

To begin with, it may have seemed to the reader that Einstein's original basis and the writer's addition thereto given in the first paper — the basing of all Physics on the fundamental affine linity E_∞ — is somewhat artificial. I propose on the contrary to show that it is scarcely possible to conceive any simpler principle that can be reconciled with the beliefs of all relativists when one tries to put those beliefs down in a definite mathematical form. We all believe that the foundation is some reality (called action) situated at each element

$$db = dx_1 dx_2 dx_3 dx_4$$

of a four-dimensional continuum, and the relative values of the portions of action in neighbouring elements. In a word we believe that there is no "action at a distance", but that everything is to be deduced in invariantive form from ^lW and its derivatives of all orders, where ^lW (henceforth to be used in place of ^lH of the first paper) is the action density. The existence of such invariantive form is not obvious: much less is it obvious that we can obtain relations which are so far invariantive that they do

not even depend on the particular value given to ${}^{l}W$ but are true simply and solely because ${}^{l}W$ and its derivatives are of their respective classes. But this is precisely what the principle of our first paper ensures, though the reader may not be prepared for this statement, and our first task must be to establish it.

It is frequently more convenient to work with the logarithm of such a density as ${}^{l}W$ rather than with ${}^{l}W$ itself. Let x be any log-scalar-density, that is x is of the same nature as $\log {}^{l}W$. We have first to consider how to arrive at invariantive relations among

$$x,\ \Delta x,\ V_0\alpha\Delta\,.\,\Delta x,\ V_0\alpha\Delta\,.\,V_0\beta\Delta\,.\,\Delta x,\ \text{etc.},$$

where, as usual, α , β , etc., are any number of contravariant vector dummies.

Now, from the history of dealing with such continuums as we have under consideration, from Riemann to the present day, it may be taken for granted that the problem as so stated necessitates that our continuum must possess structure. (It is open to argument that without such structure we have provided no physical foundation at all.) Riemann provided this structure by the quadratic differential form. Civita-Levi, Weyl, Eddington and Einstein have developed what must be regarded as a generalisation more natural to our present point of view.

The basis of their structure was an intrinsic increment (due to parallel displacement) of vectors covariant or contravariant. But from our point of view an intrinsic increment of density (a scalar) is more fundamental. Let us put, in definite forms in parallel, the meanings of these two intrinsic increments. The use of the word intrinsic in these two senses implies the following two equations

$$x_\alpha = (D_\alpha - S_\alpha)x = V_0\alpha(\Delta - \nu)x \qquad (1)$$

$${}^{c}\tau_\alpha = (D_\alpha - E_\alpha){}^{c}\tau \qquad (2)$$

where the expressions on the left, $\mathfrak{x}_\alpha$, ${}^c\tau_\alpha$, are absolute increments of the scalar $\mathfrak{x}$ described above, and of a covariant vector ${}^c\tau$. These absolute increments $\mathfrak{x}_\alpha$, ${}^c\tau_\alpha$, are furnished by comparison with the intrinsic increments $S_\alpha \mathfrak{x}$, $E_\alpha {}^c\tau$ which are dependent on what may be termed the parallel displacement α (an infinitesimal contravariant vector) and quite independent of choice of coordinates. D_α merely stands for the ordinary differential operator $V_0 \alpha \Delta$ . . E_α is a linity of ${}^c\tau$, the linity itself being linear in α ; similarly S_α is a linity of the scalar $\mathfrak{x}$, the linity itself being linear in α ; that is to say S_α is of the form $V_0 \alpha \nu$, where ν is a vector. It follows that E_α , S_α , ν , are non-invariantive. Although non-invariantive the relations of these symbols to change of coordinates are quite simple, and it is rather surprising that, so far as I know, they have not hitherto been given in the case of E_α .

From the meaning just given to "intrinsic" it follows that $\mathfrak{x}_\alpha$ is a scalar density and ${}^c\tau_\alpha$ is a covariant vector. From this alone follow readily the relations just mentioned of E_α and ν , whether the change of coordinates be finite or infinitesimal. In the present paper infinitesimal change only will be treated of.

The reader will find no difficulty in proving that

$$\delta' \mathfrak{x} = -V_0 \Delta\sigma, \delta' V_0 \alpha \nu = -V_0 \alpha \Delta \, . \, V_0 \Delta\sigma \qquad (3)$$

$$\delta' V_0 \gamma E_\alpha {}^c\beta = -V_0 \gamma \Delta \, . \, V_0 \alpha \Delta \, . \, V_0 {}^c\beta\sigma \qquad (4)$$

where δ' and σ are the δ and ϵ used in equations (2), (3), of Art. 15 of M.D.I. (2), in which place infinitesimal change of coordinates was first considered in our notation. (For σ see Art.4 on p. 14 above.)

Note that nothing whatever has been added here to

the meaning (as originally introduced by Weyl and Eddington) of the affine linity E_α . I have in M.D.I. (3) already shown that absolute differentiation is a consequence of the meaning.

Note also some important pure mathematical truisms. Let x , ${}^0x$ be two scalars of type x ; ν , ${}^0\nu$ vectors of type ν ; and E_α , ${}^0E_\alpha$ two affine linities.

Then:-

(1) $x-{}^0x$ is an invariant. $\nu-{}^0\nu$ is a co-variant vector. $E_\alpha-{}^0E_\alpha$ is invariantive, i.e. it is a coexco vector linity whose form is linear in the contravariant vector α .

(2) Therefore the general values of x , ν , E_α , are given by

$$\left.\begin{aligned} x &= {}^0x+y,\ \nu = {}^0\nu+{}^c\nu, \\ E_\alpha &= {}^0E_\alpha+Y_\alpha \end{aligned}\right\} \qquad (5)$$

where y is an invariant, ${}^c\nu$ a covariant vector, Y_α a coexco vector linity which is linear in α . ${}^0x$, ${}^0\nu$, ${}^0E_\alpha$ are in equation (5) any convenient particular functions of their respective types.

(3) Both Δx and $E_\epsilon\epsilon$ are of type ν. In particular we may take ${}^0\nu$ to be either $\Delta{}^0x$ or ${}^0E_\epsilon\epsilon$.

Thus any fundamental scalar density furnishes standard forms for the particular functions ${}^0x$, ${}^0\nu$. The early study of Riemannian Geometry provides a form for ${}^0E_\alpha$. Let ϕ be any coexcontra self-conjugate vector linity. Then defining $\phi_{\alpha)}$ by

$$\begin{aligned} 2\phi_{\alpha)}\beta = {} & V_0\alpha\Delta\,.\,\phi\beta \\ & -V_0\beta\Delta\,.\,\phi\alpha+\Delta V_0\beta\phi\alpha \end{aligned} \qquad (6)$$

we may put ${}^0E_\alpha = \phi_{\alpha)}\phi^{-1}$ More particularly we may define ϕ by saying that $\phi = 1$ in some selected system of coordinates, not merely at a single point but at all points.

Art.8. Insufficiency of Structure simpler than the affine.

A world with structure ν but without structure E_α

seems possible at first sight. $V_2\Delta\nu$ is covariant. This may be verified at once from equation (5) by putting ${}^0\nu = \Delta^0 x$ for $V_2\Delta^c\nu$ is known to be covariant. It may however be proved by a more familiar process, by summing the absolute increment of any x round a closed path and observing that as the sum equals the difference of two such values of x at a single point it must be invariant. Thus $V_2\Delta\nu$ is seen to be analogous to the general curvature derivable from the other kind of structure E_α.

Our present quest is for invariant relations as a basis, in our manifold, for a physical world. Can we find an invariant scalar density function ${}^lW$, of the two invariantive quantities

$$ {}^c\lambda = \Delta x - \nu, \quad {}^c\omega = -V_2\Delta^c\lambda = V_2\Delta\nu \qquad (7) $$

that must exist when structure involving an intrinsic x and an intrinsic ν exists? The necessary and sufficient condition that such a scalar function ${}^lW$ exists was found in our first paper (Art. 3, 4,) to be that

$$ {}^lW^c\alpha = {}^c\lambda V_0{}^l\lambda^c\alpha + V_1{}^c\omega V_1{}^l\omega^c\alpha \qquad (8) $$

where

$$ {}^l\lambda = \%^c\lambda \,.\, {}^lW, \quad {}^l\omega = \%^c\omega \,.\, {}^lW \qquad (9) $$

As usual ${}^c\alpha$ is quite arbitrary. In a general $n-$fold equation (8) imposes n^2 scalar conditions on the $\frac{1}{2}n(n+1)$ scalar partial first derivatives of ${}^lW$ with respect to the same number of independent scalar variables. The number of conditions exceeds the number of scalars at our disposal to satisfy (8). Nevertheless in a four-fold the 16 conditions of (8) are satisfied in one case. For aught we know there may exist a class of such cases, and a four-fold world dependent on the satisfaction of (8) may be possible. The case referred to is when ${}^lW = \dot{v}V_4{}^c\omega^2$ where $\dot{v}$ as usual stands for $1'2'3'4$, the product of all the primitive units.

However this be, such a world would not be that of natural physics. In it there would be no orthogonality or orthodromy or gravitation. There would only be bulk, inertia, and electric field.

Art.9. Sufficiency of the affine structure.

ν denoting, as above, intrinsic structure, and z any log-scalar-density, the covariant vector $\Delta z - \nu$ is the absolute gradient of z. To be able to compare two such gradients at neighbouring points demands the affine structure. It is desirable henceforth to limit the meaning of the affine function E_α as previous writers have done by assuming $E_\alpha{}'\beta$ to be symmetrical in α and β, that is assuming E_α to be self-conjugate in α. The general E_α resolves into the two parts, self-conjugate and skew with respect to α, and the second part (which is invariantive) has no share in satisfying equation (4), the only condition demanded of the structure.

We may now take ν to be $E_\epsilon\epsilon$, and the structure thus involves an intrinsic x and E_α. The very simplest non-singular scalar density function ${}^1W$ (based on the structure) appears to be a function of ${}^c\lambda = \Delta x - E_\epsilon\epsilon$ and of the contracted curvature (a coexcontra vector linity) denoted in our first paper by $\psi - \frac{1}{2}V_1{}^c\omega(\ )$. ${}^1W$ is now a function of ${}^c\lambda, {}^c\omega = -V_2\Delta{}^c\lambda, \psi$, where ψ is self-conjugate. The necessary and sufficient condition for the existence of ${}^1W$ now becomes

$$ {}^1W{}^c\alpha = {}^c\lambda V_0{}^1\lambda{}^c\alpha + V_1{}^c\omega V_1{}^1\omega{}^c\alpha + 2\psi\epsilon V_0{}^d\psi\epsilon{}^c\alpha \quad (10) $$

where

$$ {}^d\psi = \%\psi \,.\, {}^1W \quad (11) $$

Of the three ${}^c\lambda, {}^c\omega, \psi$ the first may be absent from ${}^1W$, but neither the second nor the third, if we are to have the full complement of n^2 scalar first partial derivatives of ${}^1W$ to satisfy (10). Physically this would seem to mean that all inertia is of electric origin and that there is but one conservation

law, the conservation of charge $V_0 \Delta^1 \kappa = 0$
It is thus of considerable interest that from our a priori mode of approaching the physical problem neither electric field, ${}^c\omega$, nor gravitation ψ , can be supposed absent. Also we may note that ignoration of a mass energy(given by ${}^c\lambda$) independent of charge seems arbitrary and artificial, for from our standpoint ${}^c\lambda$ seems more fundamental than either $V_2 \Delta^c \lambda$ or ψ.

We shall return to (10) and its connection with the energy tensor later. Meanwhile we resume our a priori approach.

Art.10. Relativity tenets carried as far as possible.

It is open to argument that the principle "physical laws are independent of choice of coordinates" applies only to the original coordinates x_1, x_2, x_3, x_4 ; but it appears more natural to regard the scalars required to specify the structure as coordinates to which the principle also applies. Can this be done?

If the physical world is finite in each of its dimensions as held by De Sitter the answer is affirmative. To apply the principle in this its second aspect we have merely to vary these new coordinates, and ensure that the only physical reality namely $\int^n \int^1 W db$ taken over the whole manifold remains unchanged. This is precisely what we did in the first paper (under the name of Stationary Action). If the manifold extends indefinitely in one or more of its dimensions we are not able fully to render $\int^n \int^1 W db$ independent of choice of the new species of coordinates. The breakdown however can be pushed away to as remote a boundary as we please, and the argument for the naturalness of the process of the first paper retains much of its force.

Here ends our a priori enquiry. Some general aspects of the results of our method will now be considered.

Art. 11. The fundamental identity of relativity.

From the physical side (10) has to be viewed as the stress form (or energy tensor: no longer a "pseudo"

tensor) of the"laws of motion". When in (10) we replace ${}^c\alpha$ by Δ the laws take on their vector force form. Note that the electric field and gravitation as well as inertia are included in our meaning of the laws. Indeed a great unification of our ideas of the physical world arises from the straightforward interpretation of (10).

This interpretation was not possible earlier. It required a rearrangement of the foundation stones of general relativity, which was gradually effected by the labours of Weyl, Eddington, and Einstein (see the second sentence of the first paper). Now for the first time we have a complete parallelism of $({}^c\lambda, {}^c\omega, \psi)$ with the velocities, and of $({}^l\lambda, {}^l\omega, {}^d\psi)$ with the momenta, of nineteenth century holonomic dynamics. Hitherto this has not been possible in the case of ψ and ${}^d\psi$. A formidable obstacle to advance was left in the complexities resulting from the second differential coefficients and the non-linear form of the contracted curvature ψ.

Denote the identically zero form obtained by removing the left-hand member of (10) to the right-hand side by ${}^lU{}^c\alpha$; and, putting dc for an arbitrary infinitesimal invariant, let the differentials $d{}^lU$, $d{}^c\lambda$, etc., be replaced by corresponding fluxes ${}^{\bullet l}U$ ${}^{\bullet c}\lambda$, where $d{}^lU = {}^{\bullet l}U dc$, $d{}^c\lambda = {}^{\bullet c}\lambda dc$.

${}^lU$ does not naturally separate into three stresses, but the flux ${}^{\bullet l}U$ is the sum of three fluxes, kinetic ${}^{\bullet l}T$, electric ${}^{\bullet l}T'$, and gravitational ${}^{\bullet l}T''$ Thus

$$\left.\begin{aligned}
{}^{\bullet l}U &= {}^{\bullet l}T + {}^{\bullet l}T' + {}^{\bullet l}T'' = 0 \\
{}^{\bullet l}T{}^c\alpha &= {}^c\lambda V_0 {}^c\alpha {}^{\bullet l}\lambda - V_1(V_2 {}^c\alpha {}^{\bullet c}\lambda){}^l\lambda \\
{}^{\bullet l}T'{}^c\alpha &= V_1(V_1 {}^c\alpha {}^{\bullet l}\omega){}^c\omega - V_1(V_3 {}^c\alpha {}^{\bullet c}\omega){}^l\omega \\
{}^{\bullet l}T''{}^c\alpha &= 2\psi\epsilon V_0 {}^c\alpha {}^{\bullet d}\psi\epsilon - 2V_1(V_2 {}^c\alpha {}^{\bullet}\psi\epsilon){}^d\psi\epsilon
\end{aligned}\right\} \quad (12)$$

${}^{l}U_9\Delta_9$ is the sum of three corresponding forces ${}^{d}\nu$, ${}^{d}\nu', {}^{d}\nu''$. Thus

$$\left.\begin{aligned} -{}^{d}\nu &= {}^{d}\nu' + {}^{d}\nu'' \\ {}^{d}\nu' &= {}^{c}\lambda V_0 \Delta {}^{l}\lambda - V_1(V_2 \Delta {}^{c}\lambda)\,{}^{l}\lambda \\ {}^{d}\nu'' &= V_1(V_1 \Delta {}^{l}\omega)\,{}^{c}\omega - V_1(V_3 \Delta {}^{c}\omega)\,{}^{l}\omega \\ {}^{d}\nu'' &= 2\psi\epsilon V_0 \Delta {}^{d}\psi\epsilon - 2V_1(V_2 \Delta \psi\epsilon)\,{}^{d}\psi\epsilon \end{aligned}\right\} \quad (13)$$

The reader should observe that (12) and (13) follow from the mere assumption that ${}^{l}\lambda$, ${}^{l}\omega$, ${}^{d}\psi$ are the first partial derivatives of some scalar density function ${}^{l}W$ with respect to the independents ${}^{c}\lambda$, ${}^{c}\omega$, ψ. A second form of the assumption is that ${}^{c}\lambda$, ${}^{c}\omega$, ψ are the derivatives of ${}^{l}W^*$ with respect to the independents ${}^{l}\lambda$, ${}^{l}\omega$, ${}^{d}\psi$, where

$${}^{l}W^* + {}^{l}W = V_0 {}^{c}\lambda\, {}^{l}\lambda + V_0 {}^{c}\omega\, {}^{l}\omega + V_0 \psi\epsilon\, {}^{d}\psi\epsilon \quad (14)$$

On these results we now superpose those following out of the method we have based on Einstein's remarkable mathematical discovery. We find that ${}^{d}\nu''$ gives exactly the expression relativists demand for gravitational force; that ${}^{d}\nu'$ gives exactly the general electric field of M. D. I. (3), (the allied equation $V_3 \Delta {}^{c}\omega = 0$ also following from our method); and that the conservation of energy must exist. To attain the accepted form for the matter term ${}^{d}\nu$ (as well as to interpret easily in any wanted sense the equation $V_0 \Delta {}^{l}\lambda = 0$ as affirming the conservation of energy), we have to make the usual assumption that ${}^{l}\lambda$ contributes to ${}^{l}W^*$ the one term $\sqrt{(V_0\, {}^{l}\lambda \theta\, {}^{l}\lambda)}$ where

$$\theta = {}^{d}\psi^{-1} \cdot \left| {}^{d}\psi^{\,1/(n-2)} \right| \quad (15)$$

The last paragraph asserts the truth of a series of statements which in their entirety may seem a little astonishing or even erroneous. It has been asserted that (13) agrees symbol by symbol with the usually

accepted equation of motion though based on different primary assumptions, and that the associated stress form or energy tensor is in no sense "pseudo". Why then, it will be asked, is the tensor of the usual theory "pseudo"?. The explanation is that our present method reveals two new identities which effect the simplification. From the single identity $d_\nu + d_{\nu'} + d_{\nu''} = 0$, from which ${}^1W$ has vanished and which involves only ${}^1\lambda$, ${}^1\omega$, ${}^d\psi$ and their Δ derivatives up to the second order, there arise three independent identities.

The facts about these three were correctly stated in the first paper, but it was not rendered clear why six instead of three do not arise. ${}^d\psi$ and ${}^1\omega$ may be given independent arbitrary values at every point, while ${}^1\lambda$ is taken to be zero. On now introducing ${}^1\lambda$ the forty-first equation $V_0\Delta^1\lambda = 0$, (required to make the integral of ${}^1W$ stationary) seems at first sight inconsistent with the previous forty equations, for ${}^1\lambda$ is expressible in terms of ${}^1\psi$, ${}^1\omega$ and E_α . Thus by a complex indirect way ${}^1\lambda$ is dependent on the previously assigned values of ${}^d\psi$, ${}^1\omega$, and the single identity is by no means an identity involving three independent symbols ${}^1\lambda$, ${}^d\psi$, ${}^1\omega$.

Let us now make a somewhat important departure from a usual procedure by supposing ${}^1\lambda$ to be involved in any way in ${}^1W^*$ instead of in the very restricted and artificial looking form $\sqrt{(V_0{}^1\lambda\theta^1\lambda)}$. On reflection the reader will I believe agree that the conservation equation $V_0\Delta^1\lambda = 0$, and the "hydrodynamic term" ${}^d\nu$ in the equation of motion claim our first attention. We use Galilean co-ordinates; and find that, in the conservation equation, $\sqrt{(V_0{}^1\lambda\theta^1\lambda)}$ $[= {}^1m]$ appears as three-dimensional density of mass-energy; and that, in the hydrodynamic equation, (on the assumption that so far as ${}^1W^*$ depends on ${}^1\lambda$ it is

some function of ${}^{l}m$) the density of matter-inertia appears as ${}^{l}m(\partial/\partial {}^{l}m){}^{l}W^{*}$ If these two three-dimensional densities are identified with each other in the strict mathematical sense, the usual assumption must be made that ${}^{l}W^{*}$ is linear in ${}^{l}m$. In the immediate neighbourhood of protons and electrons, that is where both densities are to be reckoned in many thousands of tons per c.c. the two must be identified to a very high order of numerical accuracy. Apparently at distances greater than 10^{-8} cm. the densities sink to values comparable with 10^{-7} gm. per c.c. We may well suppose that ${}^{l}W^{*}$ is of the form ${}^{l}mf({}^{d}\psi, {}^{l}\omega, {}^{l}m)$, where f is a finite invariant function of its constituents, for all values of ${}^{l}m$, inclusive of when ${}^{l}m$ is indefinitely increased.

It would seem then that we ought to call ${}^{l}\lambda$ the energy flux and reserve the name momentum vector for $-{}^{l}\lambda V_0 {}^{l}\lambda {}^{c}\lambda / \sqrt{(V_0 {}^{l}\lambda \theta {}^{l}\lambda)}$.

Art.12. The problem of matter: protons, electrons, and the Bohr orbits.

Starting from Einstein's illuminating article in "Nature" we have now arrived at a beautifully rounded off relativity scheme of physics. In direct contrast however to Einstein's concluding words, we appear to have obtained a very promising insight into the true nature of the problem presented by matter, and in what direction to attack the position.

Submitting ourselves with severe interpretation to the ordinance "do naught but carry relativity tenets as far as possible", we have found many detailed results harmonizing with natural (as opposed to a priori) physics, and not a little which was lacking from former presentations of relativity. Examples are the conservation of energy, the existence of a true energy tensor, and the formulation as an identity of the laws of motion, understood here to include electric field and gravitation. We shall now show that great atomic concentrations of matter and of electric

charge each necessarily presuppose the other. Later, general reasons will be given for expecting such concentrations, and something very like the Bohr orbits accompanying them.

The more I reflect on the dual (matter-electric) aspect of the pair of allied vectors ${}^{I}\lambda$, ${}^{e}\lambda$, the more I realise that a long-felt want has here been supplied, a basic natural and simple unification of the three great physical entities matter, electricity, and energy.

Though we may affirm that the dual aspect is prima facie evidence that a rotating mass should be a magnet, the remarks at the end of Art.11. render it improbable that any numerical deduction is possible from present-day knowledge.

We are on safer, and very interesting, ground when we observe that very high electrostatic potential (irrespective of sign) and very high material density necessarily go together. This, of course, admirably accords with our knowledge of protons and electrons.

Consider the case of a hydrogen atom, where we have very high positive and negative potentials at the proton and electron and an intervening locus at which the potential sinks to zero. This suggests that in our theory we may have to recognise the existence of negative mass. On this point one is inclined at first to argue somewhat as follows. (1) There is no a priori difficulty in supposing mass, either as energy or inertia, to be negative. (2) The total apparent mass of a proton, or of an electron, includes a term due to its charge because of the conservation of energy (though in the absence of such conservation the argument for this electric inertia seems to fail). (3) Observation shows that this total mass is, in each case, positive (for otherwise the two particles would separate), but in the case of the electron the result may be due to the positive electric term masking a negative term contributed by ${}^{I}\lambda$.

There seems, however, a very real reason preventing us from recognising negative mass. We seem instead to be impelled to assume that when we reach a point at which ${}^{l}m = 0$ we ipso facto reach a boundary of the physical world. In the arguments (1), (2), (3) above, we tacitly assumed that the single scalar condition expressed by saying that the electrostatic potential is zero gives rise to the four scalar conditions expressed by saying that ${}^{l}\lambda = 0$. For we assumed that, on each side of the locus ${}^{l}m = 0$, the scalar ${}^{l}m$ is real. Now, wherever ${}^{l}m = 0$ and ${}^{l}\lambda$ is finite our interpretation of the conditions is that the velocity of light has been attained. The simple view is that this condition holds at the internal boundary of every electron and that in every proton ${}^{l}m$ attains a very large, or perhaps indefinitely large, value.

The work of earlier writers suggests a first form for ${}^{l}W^{*}$ namely ${}^{l}m - \tfrac{1}{2}l V_0 {}^{l}\omega^{d}\psi^{-1}{}^{l}\omega$ where the "extensive" meaning understood for ${}^{d}\psi$ is that which makes ${}^{d}\psi^{-1}V_{2\alpha\beta} = V_2 {}^{d}\psi^{-1}{}_{\alpha}{}^{d}\psi^{-1}{}_{\beta}$. The considerations advanced in the last paragraph suggest a first modification of this form by the addition thereto of $-l$. The general nature of the Bohr theories suggests a further change by which the invariant coefficient of l is replaced by a corresponding exponential thus

$$\left.\begin{aligned} {}^{l}W^{*} &= {}^{l}m - l\cosh\sqrt{(V_0 {}^{l}\omega^{d}\psi^{-1}{}^{l}\omega)} \\ &= {}^{l}m - l\cos\sqrt{(-V_0 {}^{l}\omega^{d}\psi^{-1}{}^{l}\omega)} \end{aligned}\right\} \quad (16)$$

Let us enquire whether (16) should lead us to expect the automatic formation of those intense concentrations and the Bohr orbits whose existence has hitherto proved so baffling. Such an enquiry may perhaps suggest further modifications of (16) before we seriously face the labour of exact mathematical analysis. The argument will be easier to follow if we write (16) in the following invariant form

$$\left.\begin{aligned} W^* &= m - \cosh\sqrt{(D^2 - H^2)} \\ &= m - \cos\sqrt{(H^2 - D^2)} \end{aligned}\right\} \quad (17)$$

W^* stands for $l^{-1l}W^*$ and m for $l^{-1l}m$. D (displacement) and H (magnetic force) are the invariant magnitudes of the two vector densities ${}^{l}\delta$, ${}^{d}\zeta$, given by

$$\left.\begin{aligned} {}^{l}\delta &= V_1 {}^{d}\psi^{-1l}\lambda^{l}\omega, \\ {}^{d}\zeta &= -\vartheta V_3{}^{l}\lambda^{l}\omega \end{aligned}\right\} \quad (18)$$

(17) suggests that perhaps the proper form for the exponential is $\cosh D + \cos H - 1$ in place of $\cosh \sqrt{(D^2 - H^2)}$. Our quarternion notation suggests several alternative forms.

Think now of (17) in connection with the problem of the atomic concentrations, and first consider the great (mainly stagnant) interstellar spaces. We may suppose the normal condition here to be that D, H and $\theta - 1$ are all very small or zero according as radiation is present or absent. Further we may plausibly endow these great physically empty spaces with the negative property of contributing zero to the action integral. Thus the characteristic of empty space is that $m = 1$. (Perhaps a more plausible criterion for the value of m in empty space should be sought in equipartition of energy between the whole of ether and the whole of gross matter; but I believe the search will always fail from the want of a natural boundary between the two.)

When just now we said $\theta - 1$ is nearly zero in the ether we tacitly assumed that in a practical but no absolute sense it is possible to choose a system of coordinates which is natural and simple. From this point of our argument let us use such a system and permit ourselves freely to contemplate an evolution of the physical world as time progresses.

At some remote epoch in the past all the energy of the universe existed as a chaos or welter of radiation.

Gravitation at once began to make such fortuitous congestions of energy as existed still more congested and to make the emptier places still more empty. Each congestion had a high electric potential and the descending potentials in the emptier surroundings had but one limit namely zero, corresponding to a zero value of energy density. Incipient atoms had evolved from primeval chaos. Each atom consisted of a pair of singular points, at one of which was a concentration of energy and at the other a sink of potential and a boundary of the physical world. Equipartition of energy necessarily ensued, and the incipient atoms had become the hydrogen atoms with which we are familiar to-day. Needless to say the details of this brief sketch of the growth of physical law are not to be insisted upon. Rather are they given to indicate in what direction exact analysis is called for.

Similarly (17) while possessing several instructive features bearing on the possible mode of origin of atoms is not very likely to prove the exact form required. If (18) is to be of use in this problem we should expect a general explanation to run somewhat as follows. (1) For a proton D^2-H^2 is positive, and D and m assume large values. (2) For an electron D^2-H^2 is negative and m is between unity and zero. (3) The apparent mass of an electron is practicly entirely of electric origin. (4) The energy levels of Bohr's Theory no doubt depend on the periodic cosine term in W^*, but the working out of the mathematical details will probably prove difficult.

Near an isolated proton when the electron has been removed it is not improbable that, between limits of distance from the centre of the proton about 10^{-5} cm. to 10^{-10} cm., m varies approximately inversely as the distance, rising from value unity. When the electron is present it probably pushes a sort of pit or crater of unit density into these denser previously spherical layers, the crater forming a kind of cometary tail,

the electron itself being the head or nucleus. On the other hand it is possible that the critical Rydberg length, about 10^{-5} cm., is closely connected with the linear dimension of an isolated electron rather than an isolated proton, and in that case we should expect to attain the value 2 near an isolated proton, at some distance between 10^{-10} and 10^{-13} cm.

Why, it may be asked, do not the pairs of concentrations we have pictured run to the extreme of forming one great single pair instead of a vast number of atoms? Four alternative general answers seem reasonable. First, analysis may show that the pairs when once formed will be highly stable. Secondly, the large number of atoms may depend on a constant of intergration, perhaps in association with the invariant y of our first paper. Thirdly, a very large mathematical number (such as $e^{16\pi^2}$) may be involved in the ratio of the linear dimensions of the universe to those of an atom. Fourthly, the bounding vacuities inside electrons may be original unchangeable features of the universe, and form necessary nuclei for the atoms to gather round.

NATIONAL MUSEUM MELBOURNE

THE ROYAL SOCIETY
OF
TASMANIA

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The Royal Society of Tasmania was founded on the 14th October, 1843, by His Excellency Sir John Eardley Eardley Wilmot, Lieutenant Governor of Van Diemen's Land, as "The Botanical and Horticultural Society of Van Diemen's Land." The Botanical Gardens in the Queen's Domain, near Hobart, were shortly afterwards placed under its management, and a grant of £400 a year towards their maintenance was made by the Government. In 1844, His Excellency announced to the Society that Her Majesty the Queen had signified her consent to become its patron; and that its designation should thenceforward be "The Royal Society of Van Diemen's Land for Horticulture, Botany, and the Advancement of Science."

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THE ROYAL SOCIETY OF TASMANIA

PAPERS AND PROCEEDINGS, 1926

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PAPERS
OF
THE ROYAL SOCIETY OF TASMANIA
1926

NOTE ON THE ISOSTATIC BACKGROUND OF TASMANIAN PHYSIOGRAPHY.

By
A. N. Lewis, *M.C.*, LL.M.

(Read 8th March, 1926.)

1. INTRODUCTORY.

The field observations accumulated for the evolving of the theory here propounded would fill a large volume, but it is more than an impossibility to get such a work published. Without this data my theory of the evolution of our major topographical features cannot be proved. However, some prevalent ideas appear to me to be so fundamentally in error that I am tempted to put on record the bare statement of the results of three years' field work. I trust that other observers will subject this theory to the closest scrutiny, and if this paper directs attention to several features hitherto overlooked it will prove useful.

Tasmanian physiography is so closely connected with the great occurrences of dolerite (diabase) that a correct understanding of the one is essential for the deciphering of the other. Every worker in geology in Tasmania has made some contribution towards the elucidation of the problem, and this paper merely carries our knowledge a little further. The statements here contained are not proved, and await further confirmation.

The deciphering of causal processes involves the reconstruction of the history of the landscape. In this paper I commence with notes on different rock series, stressing points which throw light on physiographical development, and then I summarise the conclusions forced on me by the

field evidence. In regard to the Permo-Carboniferous-Trias-Jura rocks I accept, and my observations confirm, the statements and conclusions contained in *The Coal Resources of Tasmania*. In regard to the Devonian-Carboniferous and the Tertiary periods, the stratigraphical succession given here is based on recent field observations.

2. THE DEVONIAN-CARBONIFEROUS PERIOD.

The early Palæozoic sedimentations were brought to a definite termination by a major epoch of diastrophism occurring at the close of the Silurian or beginning of the Devonian period. Then great chains of folded mountains were formed over the present site of Tasmania, and within these granite batholiths consolidated (e.g., the granite mountains of the East Coast, and the Heemskirk Range and Granite Tor on the West). This epoch may be taken as the dawn of our present era, and divides Tasmanian stratigraphical geology in half—before it lies the ages of indecipherable physiographic conditions, and after it the historical records are voluminous and reasonably complete, merely requiring correct interpretation.

This diastrophism was followed, apparently, by a long epoch of quiescence, during which sub-aerial conditions existed over the whole of Tasmania, and which corresponds to the Devonian and Carboniferous periods elsewhere. By the end of the latter period the mountain ranges had been entirely denuded and the batholithic cores of granite exposed, in many places to a depth of 2,000 feet. Base-level peneplainal conditions existed in general, but with, certainly on the east and north, many isolated mountain peaks and, west of a line between the mouths of the Forth and the New Rivers, more elevated country.

3. THE PERMO-JURA SEDIMENTATION PERIOD.

This period, comprising rocks of Permo-Carboniferous, Triassic, and Jurassic ages, is in Tasmania one unbroken sequence, and I suggest the above name as a convenient one. It followed the last without an apparent break. At the time of the commencement of the Permo-Carboniferous glacial period the old land surface began to disappear below sea-level. Possibly the sinking commenced earlier, but only brought the rock platform to sea-level at this time. The cause of this sinking is discussed later. The following is an outline of the history of the period:—

A. Glacial Series.

This commenced just as the old rock platform reached sea-level. Where observable, deposits of this series rest on pre-Devonian rocks except at Cape Paul Lamanon, where Permo-Carboniferous limestones underlie them. Evidence points to intense ice-sheet conditions to the west, and at Wynyard and Weld River definite moraines can be found. These appear to have been dropped on a land surface. On the east and southern coasts glacial deposits appear to have originated from small valley glaciers and to have been deposited very often in shallow sea water (e.g., at Maria Island, Cape Paul Lamanon, round Hobart). The greatest observed thickness of these beds is about 2,000 feet at Wynyard, but this has no necessary connection with land movements.

B. Lower Marine Series.

Rocks referable to this series began to be deposited in the latter stages of the glacial age. Fossil evidence proves open shore line conditions and a depth not exceeding 100 fathoms. A maximum of 1,000 feet of lime- and mud-stones was deposited on a sea floor teeming the whole while with beach life, and throughout their deposition their surface was maintained at the same level, no species of the thousands entombed ceasing to flourish on the surface. Occasional bands of sandstone indicate local changes, probably referable to sea currents, and the succeeding beds of limestone show no material alteration of relative strand level.

C. Greta Series.

Then for a short time this sea floor was raised in certain localities just above sea-level, and shales, sandstones, and coal-measures were accumulated to a depth varying from 140 feet at Preolenna to 850 feet at Bruny. In other places the sea still covered the recently deposited sediments, but at a shallower depth, and marine shales were deposited (e.g., around Hobart). In the Mersey basin these were impregnated with spores or sporangia of cryptogams or algal organisms, and the Tasmanite (Mersey oil shale) beds resulted. These plants must have been growing on islands of Silurian rock which had not yet been submerged. In places Tasmanite is found directly covering Silurian strata without the interposition of marine sediments. This feature is referred to later. The rise necessary to produce these

conditions would be under 600 feet, and a corresponding amount of sediments was deposited while the surface was maintained at sea-level. Perhaps the change of conditions was due to sinking of the ocean surface. In any case, the general sinking tendency was not interrupted.

D. Upper Marine Series.

Evidently the regular downward movement continued, and the Greta series was covered by these mud-stones, the nature of which indicates very shallow, close inshore, muddy conditions. Nearly 1,000 feet were accumulated (e.g., round Hobart), and throughout the time necessary for this deposition the surface remained at approximately the same elevation in reference to sea-level.

E. Tomago Series.

The Upper Marine Series was followed by conditions just above sea-level, during which shales and coal measures were formed. At Barn Bluff these attain a thickness of 740 feet.

F. Ross Series.

Similar geographic conditions persisted for a very long while, and are characterised by the Ross sandstones, rocks obviously formed from wind-driven sand. Lagoon and terrestrial conditions are occasionally indicated locally. These rocks accumulated—after 50 feet of grits—to a maximum of 700 feet without any indication of a change of geographical conditions.

G. Felspathic Sandstone Series.

Following the Ross series is a bed of great thickness, certainly over 800 feet as observed in many localities (e.g., Fingal, Dalmayne, etc.), and, from observations at Catamaran, perhaps originally 3,000 feet in thickness. The only material changes from the last series are the greater proportion of felspar among the sand grains and a slightly more swampy and enclosed topography. For the whole of the enormous length of time necessary for the accumulation of these beds, the surface kept at the same level relative to sea-level. Bands of shale, sandstone, and coal measures alternate, and all are impregnated with fossil remains of the same species of land plants. Probably such an accumulation requires a greater time than that necessary for the deposition of a similar depth of marine sediments.

H. Knocklofty Series.

In a few localities, especially west of Hobart and at Mt. Nicholas, the felspathic series are succeeded by further sandstones, indicating a return to open sand-dune conditions, and with, at Cascades and Tinderbox, remains of sea fishes. At the type locality a thickness of 1,350 feet is attained.

The sedimentation was closed abruptly and definitely by dolerite intrusions or accompanying earth movements. Nowhere has a complete succession of these sediments been observed, and therefore definite information as to maximum depth is not available. There is a certain variation in thickness from place to place, but later events have often been responsible, and there is much overlapping when a small section in one part of the country is compared with one at a distance. Probably between 5,000 and 8,000 feet of sediments were deposited. I incline toward the higher figure.

It is not possible at present to say from where these sediments came, but it must be remembered that the present limits of Tasmania are of recent evolution. Probably land to the westward or north-westward forming a southern extension of the Australian continental mass, and of which the ancient rocks of our West Coast are a remnant, supplied the sediment. There is also some evidence of land to the eastward.

4. ISOSTATICS OF THE SEDIMENTATION PERIOD.

At any time during the very lengthy period necessary for the accumulation of these deposits, the surface of the newest sediment was never more than 600 feet below sea-level, or 200 feet above. Probably the surface did not vary 200 feet. Several series of over 1,000 feet show no alteration of geographical condition or strand line at the surface, and there is no unconformity, discontinuity, or evidence of streams or other physiographical features. It cannot be assumed that the older surface of the globe was sinking regularly and an exact equivalent volume of sediment was deposited. Even if the sinking could be so regular, the supply of sediment is not likely to be so constant, and a very definite relation is indicated between sinking and deposition. In other words, examination of these beds forces the conclusion that the accumulation caused the sinking.

Interesting proof of the general sinking of the old land surface and of the fact that this persisted over at least the present area of Tasmania and was not by local segments is provided in several localities where hills remained at the commencement of the sedimentation period. These often now stand as islands embedded in the sedimentary series, and later members are deposited directly on the pre-Devonian rocks without the interposition of earlier members as the general sinking brought these older rocks down to the sedimentation level. Thus at Barn Bluff, in places, marine mudstones lie on Proterozoic schists, but here and there over the location of ancient hills the Tomago Series rests directly on them without any of the Marine Series intervening, and at Cradle Mountain both are absent and Ross sandstones directly succeed the original platform. Again, at Ida Bay, Upper Marine limestones unconformably succeed Silurian limestones; a little farther south Ross sandstones, and farther south still, felspathic sandstones rest directly on the Silurian rocks, and in each case the floor of the more recent sedimentary series appears at the same level over the limestones as it does elsewhere in the locality over the next inferior member of its own series. At Latrobe many included islands of Silurian quartzites are found in the shale beds, and these older rocks in no way interrupt the strata elsewhere. In places down the East Coast felspathic series rocks may be seen resting on the early Devonian granite batholiths, while elsewhere, in places where the granite did not rise so high (e.g., Maria Island), earlier series cover it.

The first question that must be solved before we can proceed further is how such a delicate adjustment extending over so many millions of years could have taken place. Field evidence first forced on me the explanation of the dolerite intrusions set out in para. 6 *post.* In seeking confirmation I came to the conclusion that these sediments were gradually forcing their rock floor into a magmatic reservoir. Without the opportunities afforded in large centres, I hesitated to advance such a theory until I read an article by Mr. W. B. Wright in the Geological Magazine of May, 1925, elaborating a theory that such a process could occur. It is interesting to find this confirmation on theoretical grounds of an empirical hypothesis evolved from field evidence.

The explanation of the perfect and instantaneous adjustment to the added sentiments then is that, throughout this period, there existed deep in the crust below Tasmania

a magma reservoir which allowed perfect adjustment to added weight on the old rock platform. The pressure of the accumulating sediments squeezed the magma outward—probably towards the west. This in turn caused a gentle rise in the land surface at some distance, and allowed the supply of sediment to be maintained.

The sedimentation period closed abruptly when the magma could no longer accommodate itself to the gradual increase of pressure. The isostatic conditions during this period were therefore those of perfect adjustment due probably to the existence of a magma reservoir. Further features regarding this magma will be discussed when the dolerite intrusions have been described.

5. DATE OF THE DOLERITE INTRUSIONS.

There is no doubt in my mind that this must be fixed in the Jurassic period, while typical flora of that age was flourishing and coal measures were being deposited. The intrusions terminate the sedimentation period most abruptly. No interval elapsed between the end of the depositions and the great diastrophic events, and no Cretaceous rocks have been identified. R. M. Johnston records the inclusion of a Jurassic plant in the dolerite of Mt. Faulkner (Johnston, 1922). At the New Town brick quarry and on the shore of South Cape Bay (see also Twelvetrees, 1915), I have seen boulders of what appears to be waterworn dolerite embedded in the coal measures. There is evidence in the Catamaran coal field and elsewhere that the dolerite penetrated unconsolidated mud, and it is by no means certain that sedimentation did not continue there and at La Pérouse in local patches for a short while after the intrusions. At present all we can say is that the dolerite intrusions closed this sedimentation period in Tasmania.

6. NATURE OF THE INTRUSIONS.

Round the dolerite has grown a literature worthy of its importance, and the main features are well enough known, but several must be stressed, as they have previously been misinterpreted or, to my way of thinking, wrongly explained. The following are the vital features for our present investigation:—

(i) The Absence of Any Violence in the Course of the Intrusions.

This is the most outstanding feature in connection with this rock. It is common to find dykes up to a quarter of a

mile in width penetrating strata without any trace of disturbance. The Catamaran Dyke at South Cape Bay is 300 yards across, and intrudes coal measures. It has only affected these rocks to the extent of 10 feet alteration of level and one degree alteration of dip between the beds on one side and the beds on the other, and these differences may not have been caused by the dyke. Along Augusta Road and at East Risdon smaller dykes may be seen which do not alter the strata at all, and examples abound everywhere. Again sills up to 1,000 feet in thickness do not appear to have altered the strata above or below. At the summit of La Pérouse horizontal felspathic shales lie on the top of a sill 800 feet in depth, similar rocks exist below, and the strata are continued uninterrupted on the same horizontal level as the sill. On the Central Plateau horizontal and unaltered rocks (Ross sandstone at Arthur's Lakes, Marine mudstones at Chudleigh Lakes) lie on the top of perhaps 2,000 feet of sill, and unaltered horizontal limestones pass below it (e.g., at Waddamana). On the flanks of Mt. Wellington, Mt. Field, Adamson's Peak, Ben Lomond, and many other mountains many hundreds of feet of undisturbed sedimentary rock rest on hundreds of feet of laterally thrusted dolerite sills.

Metamorphism is always present at the intrusive contact, but in most cases I have not been able to find any trace of mechanical pressure, even when coal measures have been penetrated. Finest laminæ often continue right up to the igneous rock, which frequently meets them with a junction as sharp as a pencil line. Even coal seams are frequently penetrated without disturbance, and at Catamaran a sill of great thickness, certainly over 200 feet, underlies a coal seam by 6 feet for several hundred acres, and no trace of mechanical force can be traced in this seam. It is almost certain that this sill is intrusive.

(ii) The Dolerite Was Intrusive, At Least In Most Cases.

At times, metamorphism at the contact is obvious, although it seldom extends for a dozen feet, also there is usually a chilled margin zone in the igneous rock. But usually the only effect is an induration of the intruded rock for a few inches. However, in hundreds of occurrences examined I have never seen this absent, although, at times (e.g., at Catamaran and La Pérouse), it had to be searched for with a lens. A flow may have occurred on the top of the sedimentary series, but occurrences in lower members of the series must have been intrusions.

(iii) The Intrusions Take a Great Variety of Forms.

As has been pointed out (see *Coal Resources of Tasmania*), the dolerite is not found in any form which may be called typical, but a frequent form is that of a long dyke with a wall-like edge on one side, and on the other, one or more extensions in the form of sills, often extending for a considerable distance—these sills always having a very irregular outer edge. Mr. Nye's happy term—"asymmetric transgressive igneous mass of a general laccolithic type"—is very appropriate, but such forms may often be resolved into an irregular dyke with many offshoots, in the forms of sills, minor dykes, and latholith-like bulges. The absence of true latholiths is attributable to the mechanics of the intrusions described above. In general, it seems that the ascending dyke with its accompanying sill or sills is the typical form. So regularly do we find these features that we may almost enunciate the rule "no dyke without a sill."

It appears that the magma ascended vertically on a base of varying width, and as soon as an opportunity presented it intruded a horizontal wedge through the strata. Coal measures have been particularly attacked in this way, and the more massive members of the series are comparatively free. Often sills immediately underlie and overlie Ross sandstone beds.

(iv) The Present Dolerite Occurrences Were Originally At Very Different Levels.

In other words, the idea of a single sheet (sill or flow), as some earlier writers appear to have visualised, is not supported by field evidence. It is certain from the sedimentary rocks themselves that there was no great disturbance of these before the dolerite intrusions. To-day we find sills of dolerite intruding Cambrian or Silurian quartzites at Mt. Anne, directly overlying such rocks at Mt. Wedge, intruding Lower Marine limestones at Mt. Nelson, Ralph's Bay Neck, Cape Frederick Henry, etc., Upper Marine mudstones at Brown's River and Mt. Ironstone, Ross sandstones at Mt. Rumney, Grass Tree Hill, and Mt. Field West, felspathic series everywhere, and Knocklofty sandstones at Knocklofty, to give occasional examples only in each case. Successive intrusions throughout the whole of the sedimentation period are out of the question. Therefore, the original sills, etc., must at first have been at various levels, with a possible range of over 8,000 feet, whatever their present position may be. Where a sill is underlain and overlain by

Lower Marine mudstone, as at Mt. Nelson, and another intrudes Ross sandstone, as at the summit of Mt. Wellington, and a third intrudes Knocklofty sandstone, as at Knocklofty, the evidence points most strongly to three separate occurrences at different depths.

(v) Crystalline Structure As At Present Worked Out Affords Little Help in Deciphering Field Occurrences.

There is a great variation in the internal structure of the dolerite—from entirely microcrystalline to a completely crystallised rock with labradorite crystals 10 x 2 mm. Porphyritic structure is occasionally found, and a glassy base is common. In a few localities the dolerite passes into gabbro. It must be pointed out that the finest variety is basalt of accepted classifications. In Tasmania the term "basalt," has, by usage, become appropriated to the olivine variety of late Tertiary age, but this must not be allowed to obscure correct petrological classification.

There appears to be no absolute or constant relationship between stratigraphical situation and crystallographic structure. Small dykes and sills are usually of the finest-grained variety, and larger occurrences are usually of the normal holocrystalline type. A chilled margin zone is usually present. But none of these features appears constant. The occurrences at Mt. Anne (in Silurian strata), Mt. Nelson (in Lower Permo-Carboniferous strata), the Domain (in felspathic series), Pindar's Peak (on the very top of the sedimentary series) show exactly the same degree of crystallisation, in spite of their original difference of level. Again, on the route of the Launceston transmission line down the Central Plateau, a vertical depth of 2,000 feet of dolerite is observable. The whole of this depth shows no alteration, and is a uniformly fine-grained rock. Cradle Mountain shows the same feature to a depth of 1,000 feet, and on La Pérouse a sill 800 feet in thickness and 400 yards broad is extremely fine-grained, while a mile away at Pindar's Peak a laccolith-like extension at the same stratigraphic level shows very large crystals.

(vi) No Evidence of Vulcanism Now Exists, But It By No Means Follows That None Occurred.

It must be remembered that even if this magma ever flowed over the land surface, it has been subject to erosion since Jurassic times. Pliocene lavas in Tasmania have lost all trace of cones, vents, etc., and so we cannot point to the absence of these features in Jurassic rocks as proof that

they never existed. On the other hand, as Mr. R. M. Johnston once said:—"It seemed to him incredible that a massive "sill 2,000-3,000 feet thick could be thrust for vast distances "between planes of stratified bedding of soft coal measures, "say within 800 feet of the surface, without causing innumer- "able fissures and fractures through which some portions of "the magma would be forced to the surface in the form of "lava, ashes, etc." (Johnston, 1898.) This—with some verbal modification—is my opinion. Against such deductive reasoning we have the negative evidence that no traces of lava flows or volcanos have been identified, and the opinion that crystallisation took place under great pressure. Both these objections will be answered in a later paragraph.

Much work remains to be done on the crystallography of the dolerite, and it is possible that a careful investigation of this branch would point to valuable conclusions, but it must be studied in the closest conjunction with field occurrences—a consideration which has been often neglected in the past.

7. PREVIOUS OPINIONS.

The wealth of field evidence available and the apparent conflict between this evidence in various localities makes it difficult to discover the true sequence of events. The history of philosophical thought on this subject may be summarised as follows:—Originally the dolerite mountain caps were considered to be volcanic, and earlier than the sedimentary series which were laid down on them. All the earlier geologists appear to have held this view, including Darwin (*Voyage of the Beagle*), and R. M. Johnston incorporated it in his Geology of Tasmania. (See Johnston, 1898.) Later, contact metamorphism was recognised. I am unaware whether Mr. T. Stephens first made the discovery, but he became the first champion of this idea, and many fiery debates on this subject were staged between him and Mr. Johnston before this society. Eventually Mr. Johnston accepted the evidence of intrusion. In 1898 Mr. Twelvetrees and Mr. Petterd (Twelvetrees, 1898) read a paper embodying the results of microscopic investigations, and they there advanced the conclusion that the dolerite intrusions must have cooled under great pressure. To permit of this, they postulated many thousands of feet of sedimentary rocks as an original covering for our present mountain tops, which mass of rock was subsequently eroded away, leaving bare the dolerite sills.

In 1915 Mr. Twelvetrees (Twelvetrees, 1915 (i)) elaborated his views. He recognised the existence of many true sills, the present position of which could only be accounted for by block faulting after a period of post-dolerite erosion. He also then set out the view that once dolerite was met with, it would continue downwards indefinitely.

In 1922 the Geological Survey thus set out their opinion:—"The diabase seems to have risen from below in a "somewhat similar fashion over almost the whole of northern, "eastern, southern, and central Tasmania, but the height to "which it rose varied greatly from point to point, there being "a range in elevation of the order of 5,000 feet. It was "this variation in the height reached by the diabase which "has caused the present existence of blocks of Permo-Car-"boniferous and Trias-Jura sediments at such varying "heights above sea-level, for it was only those blocks which "were raised to the highest levels which have suffered such "denudation as to have the sediments removed which lay on "the surface of the upwelling molten mass."

It was the impossibility of reconciling this statement with the field evidence in many places, especially in Southern Tasmania, that led me to undertake the investigations which have resulted in the conclusions here summarised.

8. ISOSTATICS OF THE DOLERITE INTRUSIONS.

In the first place, the magma referred to in para. 4, *supra*, must be assumed to have existed below the platform of ancient rocks upon which the sedimentary rocks were deposited. It is difficult to give reasons for the existence of this magma, but probably the fact that Tasmania is a wedge between the Pacific Coast trend line of the Australian continental mass, running S.W. and N.E., and the S.E. extension of the southern trend line of this mass, has something to do with it. Mountain systems, valleys, faults, etc., in Tasmania all give the impression of a pinching towards the south. A significant fact, also, which I have not seen commented on before is that, whereas on the continental masses vast areas are covered by similar rocks and most systems are of considerable extent, on small islands off the coasts of these continents there is often a very great vertical range of geological systems all of small extent. This applies to Tasmania—which within its 27,000 square miles has representatives of every age since the Proterozoic and of almost every petrological species known to science—and also to England, Japan, New Zealand, and other similarly situated

islands. This leads us to the view that these appendages have been subject to every influence induced by isostatic causes. Certainly Tasmania appears to have been subjected to a rapid sequence of deposition and diastrophic epochs to an extent not equalled by any area of similar size on the continent of Australia. Whatever the reason for this may be, the pinching between the Tasman Sea and the Southern Ocean blocks of relative greater density appears to have had some effect. Perhaps these maintained a ge-anticline under Tasmania and with the release of pressure due to Devonian-Carboniferous erosion the enclosed rocks fused.

The magma began to exist from Permian times or slightly earlier. It cannot be connected with any result of the Devonian diastrophism which produced acidic magmas. The accumulation of sediments forced the rock platform deeper into this magma, or, in other words, the existence of the plutonic reservoir provided a weakness in the foundations which yielded to added weight. Up to the end of the Jurassic period the magma was able to accommodate itself to the displacement caused by the foundering segment. I reject as hopelessly speculative the theory that the Gondwana Land continent sank and simultaneously dolerite mountains were elevated in Tasmania. There is no clear evidence of the existence of Gondwana Land as a continental mass, or of its subsequent foundering, or of the date, mode, and effect of this happening. Too many intervals of time and connecting circumstances have to be assumed, and altogether it is too simple an explanation, and one for which there is not a scrap of evidence in Tasmania.

At the close of the Jurassic period either the magma completed its upward stoping process by reaching the surface or so near that its energy was exhausted or external pressure closed the paths by which it moved outwards in adjusting itself, and the added pressure squeezed portion of it towards the surface. The stage of these intrusions which we now see—that into the Permo-Jura sedimentary series—must have been accomplished at virtually the same time, and the effect where the lowest rocks of the platform were in contact with the magma for a long while has not yet been exposed to view. But, from whatever reason, these sedimentary rocks foundered in the basic magma.

As has been explained, there was an entire absence of violence. In many places whole segments of strata have disappeared, and it is clear they have not been pushed up-

ward by the dolerite (e.g., at Mt. Royal Point, Brown's River, Ralph's Bay Canal, and many other localities). The inference is that they completely foundered in the viscous mass, and their place was taken by igneous rock. The mechanics of the intrusion appears to have been a stoping process, with, apparently, a certain horizontal splitting and often a sinking of separated wedges. There is an entire absence of evidence to show that this magma could or did raise our mountains to, approximately, their present position, and these features can be satisfactorily explained otherwise. Our only evidence shows that the dolerite intrusions or earth movements accompanying them raised the land above sea and coal swamp level. If the older rocks were of greater density than the dolerite they would have tended to founder in it, and if they were of a less density the magma would have escaped at the break. The top of the recent sediments was at sea-level, and all we can say is that the dolerite reached that point and probably boiled over the surface and piled up into considerable domes. This explains how a dyke half a mile broad, ten miles long, and of unknown depth, could be found in coal measures without any displacement of the sediments.

The objection to this conclusion forced upon observers by field evidence, is that provided by crystallographic structure, namely, as Twelvetrees and Petterd put it, "this rock "must have cooled under great pressure." This has been accepted in the past, and the field evidence constructed to fit it, and subsequently removed by a convenient erosion. Field evidence shows that intrusive masses which must have consolidated under 8,000-10,000 feet of strata have exactly the same structure as some which must have consolidated under only a few hundred feet at most. There is also evidence that little, if any, of the felspathic series has been removed from some localities (e.g., Catamaran). Further, all that Twelvetrees' and Petterd's investigations show is that the magma crystallised to a certain extent before it radiated so much heat that crystallisation ceased. Crystallisation under pressure is only one of several ways in which the described features could have been imparted. Compare the trachy-dolerite occurrences at Table Cape and Circular Head, which no one has ever contended cooled at a great depth, yet they show crystals larger than the average in the dolerite. I have not given the necessary attention to this branch of the subject to speak with certainty, but I suggest that the magma had commenced to crystallise before

it reached the highest levels and that this crystallisation had proceeded sufficiently far to permit it being carried to a more or less complete conclusion in all except small occurrences by the energy imparted by the crystallisation. This would also explain the limited nature and occasional absence of metamorphism. But whatever the cause, we cannot stretch field evidence to fit a mineralogenetic theory.

Although it seems that the dolerite intrusions occurred as one event, there is some evidence of phases, and where normal dykes occur together with great irregular masses, the former appear to be the earlier, and the latter a result of a later continuation of the process. This certainly appears to have been the case at Catamaran and La Pérouse. Further, the fact that dykes are usually of fine-grained rock and the larger masses are coarse-grained points to the fact that the fine-grained occurrences were the first intrusions and the coarser types came somewhat later when crystallisation had proceeded a little farther. Of course, this only applies to cases in which a whole occurrence is fine-grained and not to small sill and dyke offshoots from a large mass.

9. OUTLINE OF THE SUBSEQUENT HISTORY OF OUR PHYSIOGRAPHY.

A. Development of a post-doleritic peneplain.

B. Era of Tertiary major block-faulting.

C. Tertiary volcanic period or periods.

D. Appearance of the present physiography.

E. Pleistocene Ice Age.

F. Some small local faulting (here or before E.).

These events will be touched upon *seriatim*.

10. THE TERTIARY PENEPLAINATION.

Tasmania, with the exception of a few square miles near Wynyard, does not appear to have been submerged again, and at whatever level the dolerite intrusions left the land there is ample evidence of the development of a peneplain prior to the movements which have given us the framework of our present topography.

(i) The remarkable concordance of mountain summits. Walch's Tasmanian Almanac gives the names of 39 mountains between 3,500-5,000 feet in altitude, and to these must

be added the many considerable plateaux. The idea of an ancient peneplain is forced on any observer viewing the panorama from the summit of Mt. Wellington.

(ii) In many places there exists on the top of mountain and plateau tops a definite topography which cannot have arisen from any agencies at work to-day or since the elevation of the mountain. For example, on the Central Plateau there are considerable mountains (e.g., Brady's Look Out, Dry Bluff, Mt. Ironstone, Walls of Jerusalem, and several smaller hills rising over 500 feet—1,000 feet in the case of Brady's Look Out) from the general level of the plateau. In most cases they are obviously isolated by river action in the course of the erosion of a tract of land very different from the elevated plateau of to-day. To-day lakes lie round the foot of these mountains, and no agents capable of this erosion are at work. The same is to be seen on Ben Lomond, Mts. Field, Hartz Mts., Mt. Picton, Mt. Wellington, and most of our higher mountains that are not sharp peaks.

(iii) Tertiary sediments have been accumulated in the valley of the South Esk and its tributaries and southwards past Oatlands to Jericho. These consist very largely of early Palæozoic quartzites, ore vein rock, and other ancient types. Not a single occurrence of such rock occurs in the valley of many of the streams that flow over these deposits. The pebbles are thoroughly waterworn and are typical river drifts. On the other hand, except in obviously recent and surface accumulations, dolerite pebbles are noticeably absent, yet dolerite caps all the many ranges where these streams have their source and is largely found in their valleys. Rocks similar to these Tertiary pebbles are found *in situ* on the West Coast, but are separated from the beds under discussion by the Central Plateau. Similar beds, protected from erosion by a layer of basalt, can be seen on the top of the plateau at the north edge of St. Patrick's Plains, on the road to the Great Lake, and, I am told, elsewhere on the Central Plateau. They also occur in the valley of the Derwent at Bridgewater, New Norfolk, and farther north, and around Hamilton and Bothwell, and west of Southport, in the extreme south. These accumulations are definitely post-doleritic, and appear to indicate that the present outline of Tasmania did not prevail when they were deposited, but rivers running from the west distributed them where we now find them, and that these beds were more or less

continuous, with the very considerable tertiary sediments on the West Coast.

For these reasons it appears that after the dolerite intrusions the land surface of Tasmania was subjected to a long erosion interval stretching from the beginning of the Cretaceous to at least late in the Miocene period. During this time the surface was reduced to a peneplain, and all traces of Jurassic vulcanism, if any, removed. In many places the intrusive sills of dolerite were exposed and eroded into definite topographic features, and over much of the surface accumulations up to 600 feet in depth of terrestrial deposits were built up in much the same way as similar deposits were accumulated in the Murray and Darling Valleys in Australia, at the same time.

11. THE TERTIARY MAJOR BLOCK-FAULTING.

For several years past I have been struck with the difficulty of reconciling some of our physiographic features with the theory that the dolerite intrusions *caused* the present differences of level, and for the following reasons it has been forced upon me that some other explanation is necessary:—

(i) Many of our greater valleys do not possess the characteristics that water erosion would have imparted, and at the same time it seems far-fetched to assume in general that the sides could have been pushed up by dolerite intruding from below and narrow chasms left. There is nothing to indicate such a happening. Frequently the valley side meets its floor at a decided angle, and the natural curves of erosion are absent (e.g., round the north-eastern edge of the Central Plateau), and the river meanders over a flat floor covered with flood plain deposits, and is not very actively engaged in eroding its valley.

(ii) The theory of the intrusions causing the present topography postulates a core of dolerite pushing up some segments, while leaving others as a retaining wall. Field evidence shows this has not happened. Frequent overflow lava streams would be the rule, but none such has ever been identified, neither have retaining walls nor elevated blocks.

(iii) The present mountain ranges appear to be independent of the form of the dolerite intrusions. Although dolerite caps most of the higher mountains, except towards the West Coast, there are exceptions, as at La Pérouse, many

of the hills east of the Derwent opposite Hobart, places on the Central Plateau, etc., while almost every dolerite-capped mountain has massive sedimentary beds on some flank. How can these exceptions be accounted for if the dolerite caused the elevation?

(iv) Although most of these mountains are dolerite-capped, few, if any, consist entirely of dolerite. In most cases the cap does not extend a quarter of the way down the mountain side. If the cap caused the elevation, how can the raising of the remaining portion—often 3,000 feet (e.g., on Mt. Wellington and Mt. Field)—be accounted for? No dolerite, as a rule, supports what would be a considerable mountain even if the igneous rock were removed. Surely some cause subsequent to the dolerite intrusions must have elevated these masses.

(v) In almost every case where observations can be made dolerite sills are interstratified between the intruded sedimentary rocks. When these have been tilted the included sill has been tilted with them. I have never seen a horizontal or vertical occurrence of dolerite cutting a bed of inclined strata. If the strata are inclined the dolerite is inclined with it.

(vi) Everywhere cliffs and other features of a very juvenile drainage abound, and these often in the softest of rocks. In very few places can it be definitely said that river action has narrowed the watershed. Could such conditions have persisted if these mountains had been in existence since Jurassic times? Would not we have a reason to anticipate a most mature drainage system instead of a most youthful type?

The conclusion has therefore been forced upon me that the peneplaination was followed by an epoch of block-faulting on a major scale. This block-faulting was a gradual upward movement, and originated our present physiography. It occurred after the long erosion interval had exposed the dolerite sills in many places and it bodily lifted great tracts of country with their then topography into their present position.

The dolerite exercised a considerable physiographic control, by original resistance to the weather, by presenting in some cases a tough band in the strata to the disrupting forces, and in others a definite break, and thus modifying the local trend of the fault lines and also by subsequent resistance to erosion, especially through the Ice Age. Many

spurs and shoulders of our mountains (e.g., Snake Plains behind High Peak on Mt. Wellington, "The Shoulder" on Adamson's Peak, and best of all Table Mountain) are due to the resistance these dolerite sills offered to the breaking forces. But, although these influences were sometimes considerable, this is the extent of the dolerite control in the history of our landscape.

The fact that on one side of a dolerite hill we may find lower Marine limestones and on the other upper coal measures, is to be explained by the fact that the dolerite intruded one or other sedimentary zone and subsequently a fault-break occurred along one edge of the dolerite. This is exactly what can be clearly seen to have happened in every case I have examined. To hypothesise a vertical lift below one sedimentary bed and stationary conditions, or a vertical lift to a different degree below the other, is to explain one difficulty by creating a greater.

This theory of major block-faulting is strengthened by the general recognition of such faulting round the coasts, in some coal fields, and on the mainland of Australia. Further, relatively recent block-faulting is the obvious cause of such features as the Forth Gorge and the (so-called) Alum Cliffs on the Mersey. These features could hardly have persisted since Jurassic times. Also when the vast extent of erosion that has occurred since the dawn of the Pleistocene times (e.g., the Lake Dove, Lake Judd, and Lake Seal Cirques) is considered, it seems impossible that any of our mountains could have survived since Jurassic times when it is shown that little has been eroded from their summits.

12. AGE OF THE BLOCK-FAULTING.

The only thing that can be said under this head is that it was pre-glacial. As explained, it was later than the accumulations of Tertiary river sediments. These are dated, on very flimsy evidence, as Miocene. Taking into account the amount of erosion, previous to this faulting, and on the other hand the considerable volcanic period which elapsed prior to the Pleistocene glacial period, probably late Miocene or early Pliocene is the nearest date that can be fixed at present.

13. ISOSTATICS OF THE BLOCK-FAULTING EPOCH.

The Pliocene-Pleistocene periods throughout the world seem to have been times of earth stresses and adjustments.

These were felt in different parts of the world at different times, and it seems that the earlier the stress came on any part of the surface, the less severely was it felt. The causes of these stresses have been widely discussed, and appear to be due to adjustment of a plastic interior to varying pressures of surface segments, which variations are caused by necessary adjustments to a crystallising interior and by erosion removing weight from the land segments and adding it to the ocean segments. There is no need to repeat the accepted conclusions here, and I confine myself to the results apparent in Tasmania.

In Australia, during this time, pressure was being exerted from the Tasman Sea in a general north-westerly direction and from the Southern Ocean in a general northerly and north-easterly direction. Again, Tasmania lay between these two great compression lines. It seems that these stresses were first felt in Tasmania and passed as a ripple up the East Coast until they reached New Guinea and New Britain, where their effects are still being felt. The following facts are again observable:—

(i) The faulting was without violence. In many places adjacent blocks which have been displaced several thousands of feet are only crushed for a couple of feet from the centre of the fault (e.g., at the Waterworks).

(ii) It was gradual. Many rivers were able to adjust their valleys to the changing conditions (e.g., the Huon, to be discussed at length later).

(iii) The movement was vertical. There is no evidence of crumpling and only slight signs of local horizontal displacement (e.g., the bulging on the outcrop at Catamaran and the horizontal twist of the seam there, and the existence of an overthrust block of Marine mudstone just short of the National Park railway station). Elsewhere it appears that only vertical movements occurred.

The Huon River gives us most valuable evidence as to several of the features mentioned, and deserves special consideration. This river first becomes recognisable some miles south of Mt. Wedge, wandering through a broad plain not 1,000 feet above sea-level. It could find its way thence to the sea, via Lake Pedder and the Serpentine, without any rise, or via the Arthur Crossing with a rise of 200 feet or so. Instead, it cuts in a deep valley over 3,000 feet deep between Mt. Weld and Mt. Picton, and lower down between the Snowy Mountains and Mt. Hartz. The obvious explanation is that

the Huon commenced to run when the western land was the highest and before the great mountain systems farther east came into existence. It thus provides additional proof of block-faulting as the cause of these mountains' existence. Also it proves that the eastern systems rose and not that the western sank, and that this rising was very gradual. If any of these features were not correct, we should expect the watershed to run Mts. Wedge, Anne, Picton, etc., and not to lie on the plains west of the mountains, with rivers cutting thence through the highest ranges in the vicinity. Further, but less impressive, examples may be found in other river valleys. Again, Mr. Nye has shown that there has been no appreciable movement in the Midlands valley since the basalt flows. He definitely proved that this valley is not a trough fault or rift valley (Nye, 1921). Taking these as our field observations, the explanation that commends itself to me at present is this:—A slight shortening of the earth's crust under Tasmania occurred at this time from isostatic causes; that is, pressures developing in adjacent segments were relieved by compressional movements under Tasmania. The pressure came from the south-east, against a resistant block or slighter pressure on the west, and was very deep-seated. This resulted in a succession of rather open folds, starting towards the west, at a depth certainly below any Permo-Carboniferous sediments and probably of abysmal character. In response to this folding, the surface rocks—those we now see—not being under pressure and being very friable, broke into blocks. Over the anticlines these blocks were elevated and over synclines they, in general, remained stationary.

It must be borne in mind that these blocks are really not raised to any remarkable height, 3,500 feet is about the average, and when this is compared to a rough diameter of five miles—to say nothing of over 40 miles in the case of the Central Plateau—the amount of elevation is not inconsistent with the above theory.

It appears that there have been a succession of these lines of elevation. How far west they extended it is difficult to say—this depending on the determination whether the whole of the old West Coast rocks were once covered with Permo-Jura sediments, as some small localities were. Should this prove to be the case, the western ranges may be the results of an earlier phase of the movements being described.

Mr. Clemes (Clemes, 1924) has pointed out the existence of three successively elevated plateaux at Lake St. Clair.

The oldest, including Cradle Mt., the Pelions, the Du Cane Range, and Mt. Olympus, is the most westerly, the highest, and the most thoroughly dissected. Then comes the Great Lake Plateau—barely dissected, and finally the most south-easterly—the Lake Echo Plateau, which is only elevated to half the height of the former. This sequence can be traced farther south. Mountains east of a line from Hobart to Launceston carry on a further succession of ridges and valleys, the ridges decreasing in height as you proceed eastward. Ben Lomond is the only exception. Successive steps in the elevation of the Central Plateau can be traced along the road from Hobart to the Great Lake, the first at Constitution Hill, the second between Apsley and Bothwell, and the third between Red Gate and the Steppes. The ridges are not straight or continuous, but are broken by many cross valleys. All this is what you would expect from a surface adjustment in response to a plutonic folding, and the arrangement of the elevated blocks corresponds with pressure from the south-east in a succession of ridges beginning in the west. Also the very persistent general westerly dip over so much of Tasmania, with the break on the east of each bed, is too significant to be altogether overlooked. The Bass Straits trough probably originated at this time also.

14. TERTIARY VOLCANIC PERIOD.

At some time there was a recurrence of volcanic activity. Probably there were at least two distinct phases, the earlier one being represented by the north-west and north-east basalt sheets, these being thoroughly weathered and dissected, and the later by smaller flows in the Midlands, Derwent Valley, Channel, and other localities in the south. The lava flows of this phase show far less weathering, and their flow down the river valleys may still be traced.

The date of this epoch is doubtful. It is certainly later than the Tertiary sedimentary deposits (e.g., at Wynyard and Launceston). These are classed as Miocene. And it is certainly earlier than the commencement of the glaciation. Pliocene is the tentative date, but from physiographic evidence it could not have long preceded the glacial epoch.

These lava flows are confined to the valleys, with occasional occurrences on mountain summits (e.g., on Mt. Wellington and the Central Plateau). This fact, together with the time of their occurrence, immediately suggests some relation between the volcanic activities and the block-faulting.

It seems reasonable to suppose that towards the close of the period of block-faulting the plutonic earth movements produced a second magma and later squeezed it to the surface. Perhaps it was an unconsolidated residual of the Jurassic magma differentiated to an ultrabasic facies, and squeezed upwards by these later movements. This magma has reached the surface over the base of the synclines, and in one or two localities over the apex of the anticlines—just the places to be expected in circumstances such as I have sketched. The Cygnet alkali rocks can be dated considerably earlier and before the block-faulting period, as they are affected by these movements.

15. THE PLEISTOCENE ICE AGE.

I have previously set out our knowledge of this period, and for the present it is sufficient to draw attention to one feature:—No observation has yet been recorded of isostatic recovery when the ice sheets disappeared. Hell's Gates, on the Davey River, and the terraces behind Strahan may be evidence, but the former may be due to a recent fault and the latter may be outwash aprons. There appears to have been no appreciable upward movement on the Central Plateau or the summits of other large mountain ranges. This is a point which warrants observations in the field.

16. LATER MINOR BLOCK-FAULTING.

There is some evidence of block-faulting of a more recent date than the major period. This has been responsible for such features as Bedlam Walls opposite Risdon, The Rocks, near New Norfolk, Cataract Gorge Launceston, the obvious fault running from Cape Bernier past Eaglehawk Neck, etc. Some recent interruption in drainage is evidenced by such swamps as Tiberius, Lake Dulverton, and Grimes Lagoon, and throughout the country the uneroded interruptions to normal erosion and the presence of cliffs along a fault line indicate a very recent period of faulting. But this was small in extent and has not affected our physiography beyond adding local features.

17. DEVELOPMENT OF OUR PRESENT TOPOGRAPHY.

To summarise, then, the physical outline of Tasmania is framed on blocks of country elevated to varying altitudes and consisting of relatively soft sediments with sills of very hard igneous rock intruded at various horizons. Previous

to this elevation a definite topography had been eroded, the igneous rock modifying this considerably, and this topography was elevated or not according to its position. In the course of the elevation, again, the igneous rock modified the lines of break, and after elevation it largely controlled the rate of erosion. Subsequent to this elevation, the agents of erosion, chiefly frost, snow, and ice, on the highlands have moulded the details of the landscape, and some slight faulting has added a few features locally.

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ON THE PLANTING OF THE DUTCH FLAG IN TASMANIA IN 1642.

By

Clive Lord, F.L.S.,

Director of the Tasmanian Museum.

Plates I.-III. and two Text figures.

(Read 14th June, 1926.)

The exact location of the landing place of Tasman's carpenter has excited considerable interest of late years. This has been due, mainly, to the erection of the Tasman Memorial, a work which will ever be to the credit of those responsible for it.

The site of the landing has been the subject of several discussions at meetings of the Society, but it was not until the last meeting of the 1925 session that a paper (Halligan, 1925, pp. 195-202) was read on the subject.

Previous to this Gell (1845, pp. 321-328), Walker (1890, pp. 266-284), and Mault (1892, pp. 408-412) had discussed the matter to a certain degree. In January, 1923, Mr. J. Moore-Robinson contributed an article to the daily press upon the subject, and stated his intention of publishing a paper, but this has not appeared.

TASMAN'S ANCHORAGE.

As a prelude to any discussion concerning the site of the landing it is essential to pay attention to the anchorage of the ships.

Gell (1845, p. 326) discussed this question, and considered that he was enabled to "fix the spot with the utmost "accuracy." Walker (1890, p. 278) refers to the anchorage as being to the north-west of Green Island.

In the newspaper article referred to previously (Moore-Robinson, *The Mercury*, 22nd January, 1923), the anchorage site is given as:—

South-east extremity of Maria Island N. 36 E.
North-east corner of Green Island S. 76 E.
Most northerly point of Cape Paul Lamanon S. 84 W.
Centre of pebbly beach, Prince of Wales Bay (the landing place) W.S.W.

Captain Bowerman in a report furnished to the Society states: "I might mention that when on the position that I "considered *approximately* Tasman's anchorage I took the "following bearings:—

"S.E. extremity of Maria Island N.E.¾N. (N. 37° E.).
"N.E. extremity of Green Island E. x S½S (S 76° E.).
"Most northerly part of Cape Paul Lamanon W.½S. (S. 84° W.).

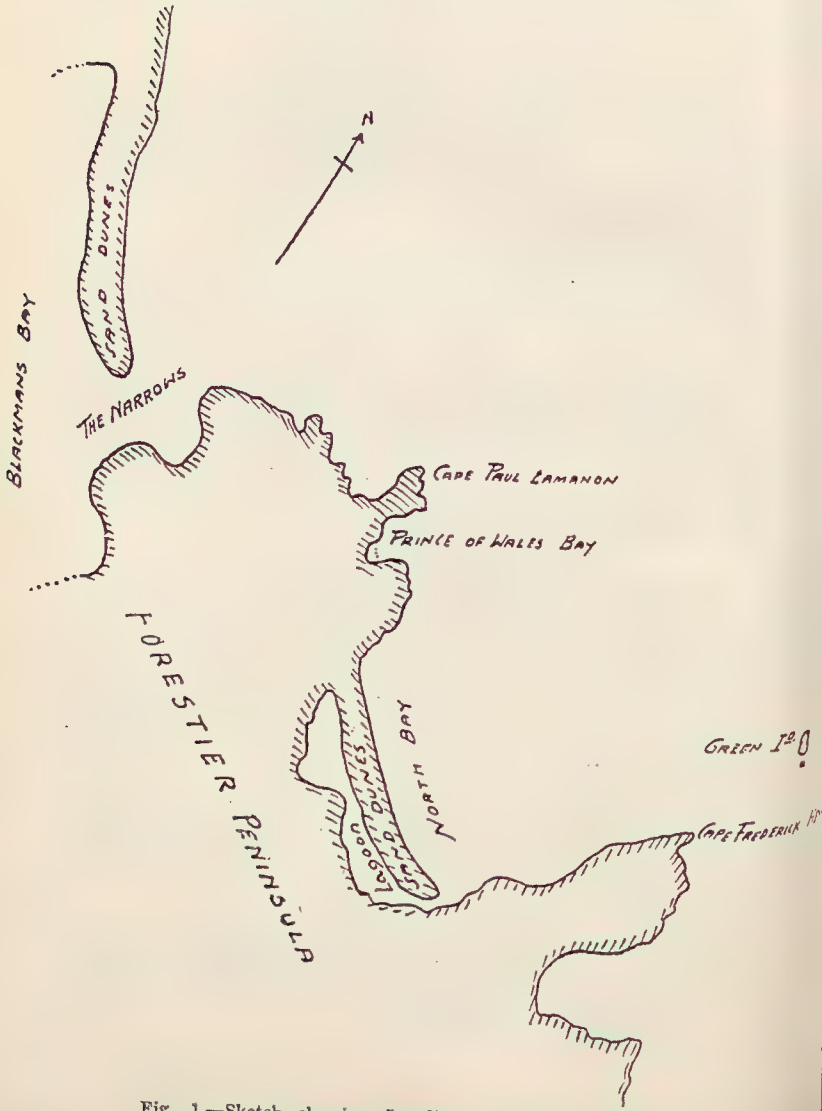

Fig. 1.—Sketch showing Locality of Tasman's Anchorage.

"These bearings were read only to the nearest ¼ "point with the eye from a position on the yacht that was "as far as possible from any local attraction, to reduce the "deviation. The reason I took them was in case anyone ever "wished to check the work the bearings would be handy as "a guide. These bearings do not make a good fix on the "Admiralty Chart, at which I am not surprised, seeing the "coast there is not accurately surveyed."

Mr. Moore-Robinson mentions in his article:—"It was "found that Tasman's bearings, like his observations, were "accurate only in a general sense. He records his variation "as being 3 degrees. It should have been 9 degrees." I am unable to find any authority for this last statement, unless the present compass variation has been accepted as applying to 1642. In comparison, however, with the records of other early navigators, Tasman's variation of 3 degrees appears to be approximately correct. (See also "Isogonic map for the Indian and Pacific Oceans for the epoch 1640." By W. van Bellemen.) In addition, other data have to be taken into consideration, including the various charts, which differ in many details, the interpretation of them, as well as the wording of the Journal. (1)

There is one point worthy of mention which the examination of the charts and sketches discloses, namely, that the *Zeehaen* (2) was anchored nearer to Green Island than the *Heemskirk*, and as observations were made on both vessels this fact may be of service in the interpretation of several items.

Mr. Halligan (1925) has totally disregarded charts and soundings, and assumed Tasman's anchorage as being well inside Green Island. His reasons for this are unconvincing, especially so when he refers to Tasman's skill as a sailor and the law of storms (page 198). The anchorage shown on the plan accompanying his paper (page 199) would have left the Dutch ships on a lee shore in the event of a northerly breeze, which was to be expected, and, as shown by the Journal, did occur later. It is far more probable that Tasman anchored out beyond Green Island near where Marion did in 1772, and, in fact, all evidence seems to support this view, although, in the absence of a detailed marine survey, the position can be fixed in an approximate manner only.

(1) Apparently Messrs. Kennedy and Moore-Robinson's party worked from Woide's translation, but the later translation by Professor Heeres is generally accepted by historical authorities as being the more accurate and complete.

(2) Tasman's ships were (1) the small war yacht *Heemskirk* (Flag Ship), of 60 tons, and having a crew of 60. (2) The Flute *Zeehaen*, of 100 tons, and a crew of 50 (Flutes were long, narrow ships, quick sailers of shallow draft, and with a good deal of ship room). *Vide* Heeres.

THE LOCATION OF THE SITE WHERE TASMAN'S CARPENTER SWAM ASHORE.

In order to arrive at the correct interpretation of the available data concerning the landing place it is necessary to review certain sections of the account given in Tasman's Journal. Tasman brought his ships to anchor on the evening of the Ist December, 1642. On the following day he sent his pilot major "to a bay situated to the north-west of "us" to examine the land, and further gives the distance as "upwards of one mile," which distance is equal to four English miles. Mr. Halligan (p. 198) claims that had Tasman been anchored east-north-east of Prince of Wales Bay there would have been no bay to the north-west of him, but examining Tasman's log and chart there can be no doubt that the bay which he referred to was the general direction of the present Marion Bay, the curving beach of which would be situated in a north-westerly direction at a distance of about four miles, and no doubt it was the general direction of the outer bay, and not the inner bay, to which Tasman referred. The boats under the command of the pilot major examined the inner bay and reported on it.

As far as we have record, therefore, the small bay inside "The Narrows" marks the spot where the first white people landed on Tasmanian shores.

The explorers returned to the ship, and, among other matters, stated that the land was inhabited probably by giants, owing to the distance apart certain climbing notches were cut in some of the trees. They had also seen smoke from fires in the distance, and heard a sound like a trumpet or small gong. This latter sound was probably the note of the black Bell-magpie (*Strepera fuliginosa*), which occurs in this locality, and has a note that has been likened by Gould to the sound of "a hammer on anvil," and by Littler to that of "a tramway gong." As regards the giants, there was a fixed idea, antedating even the voyage of Quiros, that the great unknown lands of the south were inhabited by giants.

Coming to Tasman's description of the doings on the 3rd December, he states that "we went to the south-east side "of this bay in the same boats as yesterday." Gell (1845) considered that the bay referred to was the south-east side of the present Blackman's Bay. Walker (1890) considered it was the south-east side of the present North Bay. Halli-

gan (1925) is of the same opinion as Walker. The available evidence undoubtedly proves the correctness of Gell's opinion in this respect. (3)

Throughout Tasman's account of his stay on the coast his reference to "the bay" may be taken to mean the bay to the north-west of his anchorage, inside of which was a further bay examined by the ship's boats, the entrance to which may have been in a slightly different position from what it is to-day owing to the shifting nature of the channel through the sandspit. Moreover, Tasman's references to the rocky soil, etc., agree far better with the land inside "The Narrows" than with the land at the entrance of the lagoon at the lower end of North Bay, where the land is sandy, except on the ridge running out towards Cape Frederick Hendrick, which is of rocky formation. The outstanding piece of evidence, however, is given by the charts themselves, for whilst the outline of the inner bay is given in detail, and most of the creeks running into it are shown, yet the shores of North Bay are shown in outline only, and there is not the slightest trace of the lagoon or its outlet. Had Tasman's men been ashore at the outlet and examined the lagoon, there is no doubt that they would have left a description of it and shown it on their charts. The locality visited by the boats in the morning has a bearing on the location where the flag was planted, for the same afternoon the boats attempted to return to the place visited in the morning. Similar words occur in Tasman's Journal as regards the direction taken both in the morning and the afternoon, namely, "we "went to the South East side of this bay." Now, assuming that the boats were making for the entrance to "The Narrows," everything in Tasman's Journal and his descriptions can be reconciled with the present topography of the country, but if, on the other hand, the boats had been making for the outlet of the lagoon at the lower end of North Bay, none of Tasman's statements can be made to agree with the configuration of the coast.

Taking the second case first, if the anchorage as shown on Mr. Halligan's map is correct and we follow the descriptions given by Tasman, it is clear that he would have been half-way from the anchorage to the entrance to the

(3) On another aspect, it is of interest to note that Gell considered that the true Frederick Henry Bay of Tasman was the small cove now known as Prince of Wales Bay. It is generally accepted that the bay referred to was meant for the inlet now known as Blackman's Bay, though there is some evidence that Tasman meant the name to cover the outer as well as the inner bay.

lagoon before it came on to blow strongly from the north, and this would have given a fair breeze into the lagoon; but Tasman refers to one boat pulling back to the ships while the pinnace ran on to an inlet which bore west-south-west of the ships. Mr. Halligan assumes that Tasman landed in the centre of North Bay, and has marked on his map "flag-staff erected here." It is difficult to understand how Mr. Halligan could arrive at this conclusion. Had the boat gone to the lagoon they would have carried on to the lower end, and not made up to the centre of the beach. Moreover, there is no small inlet as mentioned by Tasman in this position. Further, with a northerly breeze a heavy sea with a big break runs in and meets the sandy shore of North Bay. Anyone who has seen the locality in a northerly breeze would recognise immediately that it would be quite impossible for the carpenter to have swum ashore with a staff in such a locality—much more to have ever got back to the boats through the heavy surf and the undertow which sets along the shore. Moreover, there is no sloping ground clothed with giant eucalypts near to these moving sand dunes.

Taking the other case, and assuming Tasman's anchorage as being outside Green Island in the position shown on his chart, the true facts of the case are plain for all to see if a little care and attention are paid to the Journal and the charts and sketches accompanying same (*vide* Heeres' *Tasman*).

The two boats leaving this anchorage commenced their journey towards "The Narrows," but when half-way, that is, in the vicinity of Cape Paul Lamanon, a northerly breeze came down very strongly, forcing the smaller boat back to the ship, whilst the pinnace was run inshore to where one would anticipate a sailor would make for, namely, under the lee of the high land forming the cape. There appears to be no question that the bay now known as Prince of Wales Bay was the inlet referred to by Tasman as bearing west-south-west of his ships, as it meets with all the conditions as described in his Journal. Moreover, if the sketches accompanying his Journal are compared with the present topography of the land, almost the exact spot where the flag-staff was erected can be easily arrived at, for it is plainly shown as being the north-west shore of the bay.

Prince of Wales Bay is situated at the foot of a steep ridge, one arm of which runs out towards Cape Paul

Lamanon. The bay is quite a small inlet, and towards its head there exists a bar of stone upon which from both sides of the bay there jut out reefs of stones which serve to form an inner cove to the bay. In rough weather the sea breaks upon this with relentless force. It has been said that the reef was formed by the "bay whalers" in order to make a boat harbour, but there can be no doubt as to its natural formation, although the "bay whalers" may have added to it in some degree. It would need an immense amount of labour to make any material difference to the reef, and in the absence of any direct proof the legend that the "bay whalers" built the reef must be viewed with grave doubts. The main part of it is most certainly of natural origin, and it is only a small portion of the superstructure which admits of discussion on this point. A change of structure in the rocks is very noticeable here, and may be largely responsible for the shelf-like reef. A fault can be seen plainly at the base of Cape Paul Lamanon, particularly on the exposed cliff section on the northern face.

Personally, after an exhaustive examination of all available documents, obtaining opinions from authorities in Europe as to charts, etc., and two extended visits to the site, I am of the opinion that the party who made the original selection for the site of the monument (*vide Mercury*, 22/1/1923) failed to locate the correct position on the landing place of Tasman's carpenter, and also that the position as marked by Mr. Halligan is equally at variance with the evidence.

Considering that the wind was blowing strongly from the north (not from the east as some authorities have stated), there would be a great break on the reef, particularly as, according to certain calculations, the tide was low. (Halligan, p. 202.) Tasman refers to the surf, so that it is extremely unlikely that his boats would have crossed the bar, especially as the northern shore of the bay would be more sheltered. Moreover, the sketch in Tasman's Journal definitely shows the flag on the northern shore of the bay, and the description of the sloping ground agrees far better with this position than with that at the head of the inner cove. It is questionable if there are any traces left of the original trees noted by Tasman, but it is easy to find four stumps in either position. A comparison of a recent survey of the bay with one made over half a century ago shows a fair amount of erosion of the inner northern shore of the

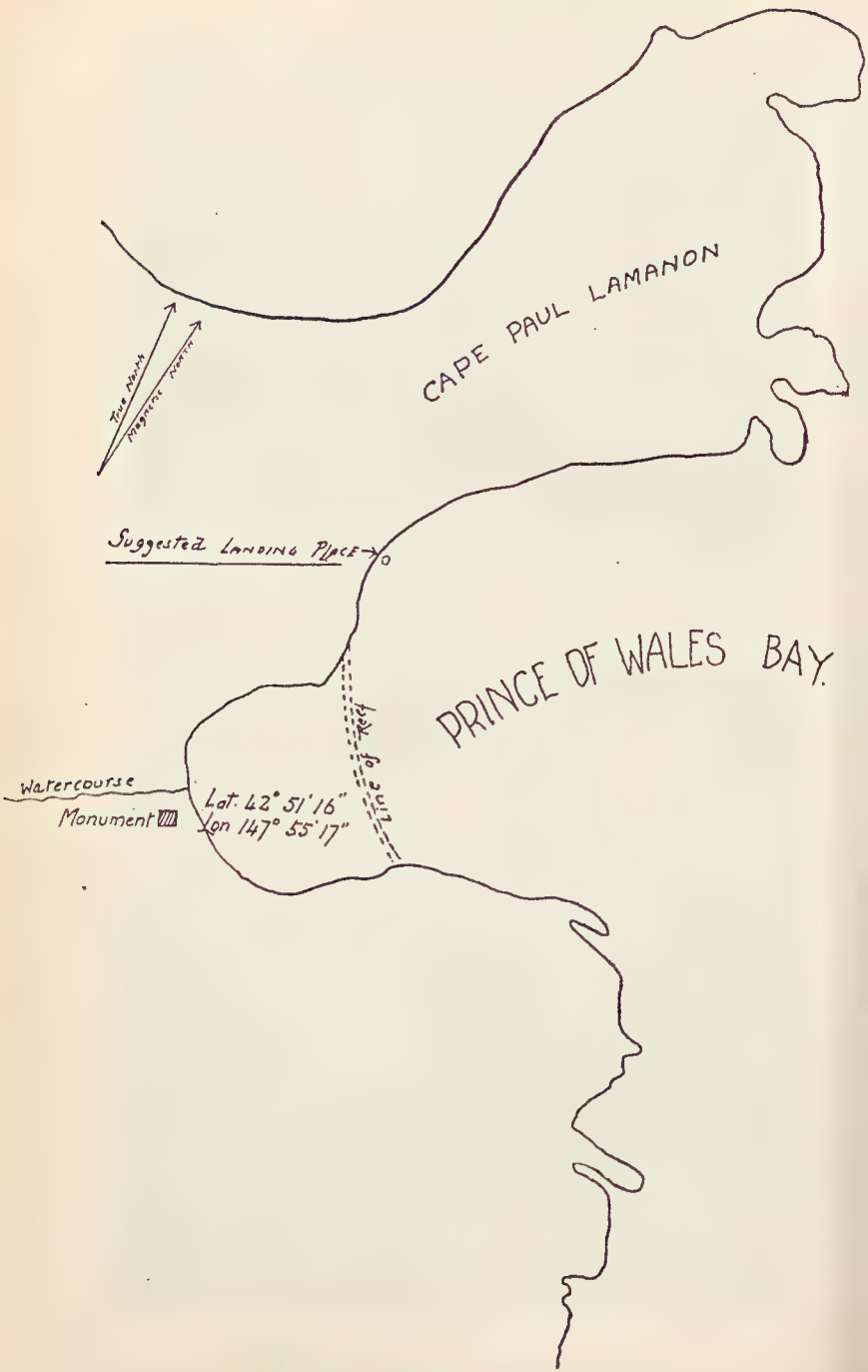

Fig. 2.—Sketch of Prince of Wales Bay.

Fig. 1.—Outer Cove, Prince of Wales Bay, in Northerly breeze, showing calmer water under lee of Cape Paul Lamanon.

Fig. 2.—The suggested site of the landing on the Northern shore of Prince of Wales Bay.

Fig. 3.—The Reef, Inner Cove, Prince of Wales Bay. Green Island in distance.

Fig. 4.—Looking North across the Bay, showing break on Reef.

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Fig. 5.—Prince of Wales Bay, looking South-East. Green Island and Cape Frederick Hendrick in distance.

Fig. 6.—The Entrance to the lagoon, North Bay.
Clive Lord, Photos.

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bay, and down among the shingle on the beach just outside the reef remains the enormous stump of a very old eucalypt. If any tree might have a claim as being Tasman's tree, I think that this one might well be considered, for, so far as I can gather from the available evidence, it occurs just at the spot where the carpenter apparently swam ashore. Moreover, it is just as easy to find four stumps here as in the position at the head of the bay, but considering the lapse of time too much reliance should not be placed on trees.

It is of interest to note that Gell (p. 326), in describing the cove now known as Prince of Wales Bay, wrote as follows:—"Nearer its northern than southern extremity the "sea has cast up a key of large grey rounded ironstones "which interrupts the curve of the beach, and doubtless "marks the very spot where the carpenter swam ashore."

Walker wrote:—"Standing just outside the shingle bar "at the entrance to this inner cove it needs no great effort "of imagination to call up the scene on that 3rd December, "1642."

Taking these opinions, together with the sketches in Tasman's Journal, into consideration, it is difficult to understand how many of the statements made in regard to the landing came to be written.

The discussions in regard to the site have been of value, and should assist in enhancing interest in the early history of our island State. Too much credit cannot be given to those who made the erection of the Tasman Memorial possible, and any criticisms in regard to the interpretation of historical or scientific data are quite apart from the erection of the memorial. It is to be hoped that other memorials will be erected in the near future. The visits of such navigators as Furneaux, Cook, Bligh, D'Entrecasteaux, and Baudin are well worthy of commemoration.

EXPLANATION OF PLATES.

Plate I.

Fig. 1.—Outer Cove, Prince of Wales Bay, in northerly breeze, showing calmer water under lee of Cape Paul Lamanon.

Fig. 2.—The suggested site of the landing on the northern shore of Prince of Wales Bay.

Plate II.

Fig. 3.—The Reef, inner cove, Prince of Wales Bay. Green Island in distance.

Fig. 4.—Looking North across the Bay, showing break on Reef.

Plate III.

Fig. 5.—Prince of Wales Bay, looking East. Green Island and Cape Frederick Hendrick in distance.

Fig. 6.—The entrance to the lagoon, North Bay. Cape Bernier and Maria Island in distance.

Clive Lord, Photos.

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NOTES ON THE CONSTITUTIONAL SEPARATION OF TASMANIA FROM NEW SOUTH WALES

(3rd December, 1825).

By

JOHN REYNOLDS.

(Read 9th August, 1926.)

In the year 1824 public opinion in Tasmania first forcibly expressed itself on a political question. The colony had passed the elementary stage of its growth, and a change in the form of government was necessary for its well-being and future development. No longer was it desirable that it should be ruled by a Governor at Sydney, who was possessed of almost autocratic powers. At the very most the Tasmanian Lieutenant-Governors were merely his subordinates, and the colony was feeling the ill-effects arising from the limited scope of local authority.

Fortune favoured the colony in two respects at this period. Firstly, the prominent colonists clearly discerned the nature of their troubles, and were capable of acting together to obtain their removal. Secondly, the British Government recognising that eventually a change in the administration would be necessary, had made provision for effecting it at some future date. The fact that the machinery for the removal of their disabilities had been made, but was placed, as it were, in storage for future use, roused the colonists to action. After preliminary meetings, a petition was drawn up for presentation to H.M. King George IV. The petitioners prayed that the section of the Act 4 *Geo. IV.*, which provided for the erection of the colony of Van Diemen's Land completely separated from New South Wales should become effective. Provision in the Act had also been made for the appointment of nominated executive and legislative councils to assist in the government of the colony. The petition was not lengthy, and was signed by over a hundred colonists, including nearly all the leading settlers, merchants, and magistrates. Within the limits of the following paragraph the petitioners confined the main statement of their case.

"That, although the people of this Island have had "to combat with all the difficulties incident to a new "country, without many of the aids and facilities enjoyed "by Colonists of New South Wales, they have neverthe- "less made proportionately greater advances. But, as, "in Soil, Climate, and Geographical relation, this Island "essentially differs from that Country, as its present "State, moral and physical, cannot be referred to the "same Causes, neither can their future welfare and pros- "perity be identified with or promoted by the same policy "and measures, and which, however applicable and ad- "vantageous they may be to that Settlement, have been "recently felt alike unsuited to the condition and pre- "judicial to the welfare of this Colony." (1)

It is quite plain what the petitioners wanted, but their statements concerning their political disabilities are not nearly so definite. Nevertheless, they satisfied the British Colonial authorities, who were well supplied with official information on the subject. This petition is one of Tasmania's most interesting public documents. The achievement of its object had a far-reaching effect, so naturally we want to know more of the circumstances which brought it into being. An examination of the extant historical documents and papers of the years immediately preceding 1824 does not furnish an adequate view of the position. For this it is necessary to go right back to the foundation of the colony. From a brief review of the relations between the successive Governors of New South Wales and their subordinates in Tasmania this in some measure can be obtained. Owing to the personal nature of the Government, these men guided the destinies of the colony, so their actions were of great consequence.

When Governor King despatched the first party to settle in Tasmania, it was most necessary for him to keep a very close supervision over the Commandant (Lieutenant John Bowen, R.N.). He was acting on his own initiative. The fear of the French annexation seemed confirmed by the presence in Tasmanian waters of Commodore Baudin's ships, and several American sealing ships hovered around the islands in Bass Straits, making themselves a nuisance to the penal settlements. It is not surprising that among other

(1) Memorial to H.M. King: Hist. Rec. Aust., Vol. 3, Ser. III., pp. 578-80.

clearly defined instructions he gave the following to the youthful commandant:—

> "You are not to permit any intercourse, or trade, "with any ships or vessels that may stop at Van Diemen's "Land, whether English or of any other nation, unless "such ships or vessels should be in distress, in which case "you will afford them such assistance as may be in your "power." (2)

This is a good example of an application of the great powers that a Governor of New South Wales possessed.

King, as Governor of New South Wales and its Dependencies (including Tasmania), was indeed possessed of very wide powers. He legislated, administered, and almost controlled the judiciary. (3) His successors until 1823 held the same powers, but possibly a little diminished in the latter sphere. So to all intents and purposes their will was law in matters concerning Tasmania.

Colonel David Collins with an expedition from England and Colonel W. Paterson with one from Sydney followed in Bowen's unfortunate steps. Their arrival marks the definite foundation of the colony in the south and north of the Island. King's relations with each of these men were excellent from an administrative point of view. (4) Undoubtedly he fully appreciated the nature of the task of planting a new colony, as he had gained similar experience at Norfolk Island. Collins was in particular allowed a considerable freedom of action, and received every assistance from his superior. This was the only conceivable way that such a system of government could work efficiently and smoothly.

Captain William Bligh, King's successor, had very little to do with Tasmanian affairs. During the famine of 1808 he assured Collins that the Tasmanian colonists would suffer no more than their brethren in New South Wales. After his deposition he visited Hobart and attempted to govern, but his actions were repudiated by Collins, and have no interest at present.

The Sydney Governors legislated by means of proclamations and general orders. Many of these edicts contained legis-

(2) King to Bowen: Hist. Rec. N.S.W., Vol. 5, p. 76.

(3) King's commission: Hist. Rec. Aust., Vol. 3, Ser. I., pp. 384-90.

(4) King's instructions to Paterson: Hist. Rec. Aust., Vol. 1, Ser. III., p. 601.

lation beneficial to both colonies, but it is not hard to find instances where their application to Tasmania was harmful and even ludicrous. The inability of the Governor-in-Chief to calculate the effects of his legislation, however good for New South Wales, upon Tasmania was one of the worst defects of the system. Unfortunately, the only Governor who had a first-hand acquaintance with Tasmanian affairs (Macquarie) handled them the worst.

From 1813 to 1817 this delicate system could hardly have been in the hands of worse operators. Colonel Lachlan Macquarie was the Governor-in-Chief and Colonel Thomas Davey the Lieutenant-Governor of Tasmania. Macquarie was in many respects a remarkable man. Energetic and efficient in administration, exemplary in private life, but arbitrary in his actions to the point of tyranny.

Davey, his subordinate, differed from him in almost every respect. Easy-going and inefficient in administration, good-natured and dissolute in his private affairs. Macquarie owed his position to ability, Davey to influence. At the commencement of Davey's term of office, Macquarie, being well informed of his subordinate's ways, prepared for him a lengthy list of instructions. (5) In them he narrowly defined Davey's discretionary powers. Every item of Government expenditure had not only to be reported, but justified. Without Macquarie's sanction he was not allowed to charter ships, enter into contracts for supplies, grant lands, erect buildings, or alienate live stock. Two instances will be given to demonstrate how the colony suffered through the inability of these two men to work together and follow the example of their predecessors, King and Collins.

(1) The inability of Davey, or his commissariat officers, to draw bills on the Treasury for payment of supplies purchased was a serious handicap to the colony. It meant that the drafts they gave were only payable at Sydney. Before a settler or merchant received his payment for the produce he had sold, weeks or even months might elapse. In the meantime, his creditors had to wait. This obstruction to commerce had a detrimental effect on the progress of the colony.

(2) It was the misfortune of the colony that just at the period when the wheels of government were not running at

(5) Macquarie to Davey: Hist. Rec. Aust., Vol. 2, Ser. III., pp. 13-23.

all smoothly, a very serious trouble should arise. Since the earliest days of the settlement there had been always a few lawless men, ex-convicts and others, wandering in the bush, living by robbery and practising all kinds of violence. With no Criminal Court in the colony, so that all offenders had to be sent to Sydney for trial, the moral effect of immediate punishment was lost. In 1815 bushranging had increased to such an extent that all the settlements were in danger of being plundered. One chieftain of a band of desperadoes audaciously challenged Davey's authority. To meet the situation Davey took the only course open to him. He proclaimed Martial Law. (6) The results seem to have justified his action, and the settlers expressed their appreciation of Davey's action in the form of an address. (7) Now, although Davey had a good colonial precedent for his action, Macquarie condemned it. Later he admitted that Davey's action was correct.

In this period there were many examples which demonstrated the defects of the Dependency system of government. One of the most outstanding of these is given below. It will be seen that in this case no blame can be laid on the shoulders of Davey. For its revenue, the administration in Tasmania depended mainly upon duties imposed on imported spirits. From this source came the money to pay for developmental work, such as the clearing of land, road-making, and building. Macquarie, probably without considering the effects of his action, deprived the colony of this useful financial asset. He entered into an agreement with three Sydney men, whereby they built a Government Hospital at that place for the privilege of importing all spirits into the colonies for four years. (8) All importing was done through Sydney. Davey strongly protested to the Earl of Bathurst, the Secretary of State for the Colonies, but without result. (9) Development work, so necessary for the young colony, appears to have come to a standstill whilst the monopoly lasted.

After four years of official wrangling and hard living Davey was succeeded by Colonel William Sorell. The new Lieutenant-Governor was not merely an excellent administrator, but also possessed the qualities of a far-sighted states-

(6) Hist. Rec. Aust., Vol. 8, Ser. I., pp. 133-4.
(7) Address to Davey: Hist. Rec. Aust., Vol. 2. Ser. III., pp. 133-4.
(8) Hist. Rec. Aust., Vol. 7, Ser. I., pp. 401-5.
(9) Davey to Bathurst: Hist. Rec. Aust., Vol. 2, Ser. III., p. 149.

man. He was able to work with Macquarie, and during his term of office the colony advanced at great strides. Nevertheless, Macquarie did not see fit to grant him the same freedom of action that Collins had enjoyed. However, Sorell did manage to effect one partial reform. By an arrangement, the Deputy-Commissary General in New South Wales allowed his subordinate in Tasmania to draw bills directly on H.M. Treasury to pay for supplies bought. This was only a departmental arrangement, and depended upon the degree of trust existing between the two officers; at any time it might be terminated. Sorell estimated that the community was thus saved to the extent of 25 per cent. in its financial dealings. (10)

Macquarie in his turn was succeeded by Sir Thomas Brisbane. This change of Governors-in-Chief did not greatly affect Tasmanian affairs. With the large numbers of free emigrants who were arriving the roundabout method of granting lands from Sydney was becoming more difficult to work and causing much inconvenience and delay. It was Brisbane's misfortune to have to introduce a number of necessary but unpopular reforms. He made sweeping changes in the currency, and introduced a new system of purchasing supplies. These measures gave rise to vigorous opposition in New South Wales. They applied equally to both colonies, so could not be considered a special grievance of Tasmania. No doubt their introduction did help in Tasmania to fan the flames of dissatisfaction with the state of affairs.

To return to the petitioners. A few of them had witnessed the best working of the system in the days of Collins. A far greater number had seen only the days of Davey. Probably many were then new settlers, and in the days of their pioneering struggles had to suffer what was, in many respects, gross misgovernment. Whilst this system remained, no matter what beneficial arrangements for smooth working were made between the authorities, there was always a possibility of a recurrence of that evil.

The prayer of the colonists did not fall upon deaf ears. The British Government took steps to fulfil their wishes almost immediately. When Brisbane retired it was decided that Lieutenant-General Sir Ralph Darling should succeed him. When Darling left England he was given two commissions, one appointing him Governor of New South Wales,

(10) Sorell to Bathurst: Hist. Rec. Aust., Vol. 4, Ser. III., p. 577.

the other one appointing him Governor of Tasmania. (11) On the voyage out Darling called at Hobart, arriving on the 24th of November, 1825. During the next nine days all arrangements were made for the various ceremonies which were officially to mark the change in the system of government. At last the eventful 3rd of December arrived. Darling took the various oaths of office, and so became Governor of Tasmania. He immediately issued a proclamation, which is extant, announcing the separation of the colony from New South Wales. But Darling had no intention of remaining in the colony, and on the 5th of December he left to take up his duties in New South Wales. Lieutenant-Governor Arthur (who had succeeded Sorell) thus became Acting-Governor after taking the oaths of office. On the 12th of December Arthur issued a proclamation appointing the first nominated executive and legislative councils.

The passing of the cumbrous Dependency system of government, of the unchecked powers of the Governors and the growing strength of public opinion, were signs that the little craft of state was entering upon new waters. The old problems of government prior to 1825 mainly disappeared and were forgotten, and the path was cleared for the solution of the new ones which quickly arose. Outstanding among these were the aboriginal question, the freedom of the press, the raising of revenue, and the transportation system. So the citizens of Hobart who illuminated their dwellings and lit bonfires on the night of 3rd December, 1825, were rightly celebrating the birth of a new era in the history of their country.

The writer wishes to record his appreciation of the assistance he has received from Mr. W. F. Dennis Butler in the writing of this paper.

(11) Darling's commission: Hist. Rec. Aust., Vol. 5, Ser. III., p. 1.

THE OIL SHALES OF TASMANIA.

By

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(Read 14th June, 1926.)

INTRODUCTION.

It was the original purpose of the writer to deal with the two types of shale, namely, tasmanite and the so-called torbanites or kerosene shales, but as the subject assumed such large proportions it was decided to confine attention to tasmanite only. Much research is still necessary in order to decipher the problems unsolved relating to the actual nature of the oil-producing organic matter and also to the nature of the oils produced in the processes of distillation. The information contained herein, whilst adding to our general knowledge of the subject, should prove an incentive to further investigation.

HISTORY OF DISCOVERY AND DEVELOPMENT.

The name of the discoverer of oil shale in Tasmania was not recorded in the annals of that time. The earliest account appears in the "Papers and Proceedings of the Royal Society of Van Diemen's Land" in a paper read by J. Milligan in the year 1851. Since its discovery so many years ago the deposits have continued to excite the attention of scientists as evinced by the large number of contributions to our knowledge from the pens of many investigators; but until recent years it has proved of passing interest only to investors, as its exploitation was not considered a commercial possibility. In the early nineties a local company was formed to explore the seam and determine the value of the shale as a source of oil. The early history of the industry is essentially the history of the operations of that company. After an expenditure of many thousands of pounds without return the present members of this company remain hopeful, and expect soon to receive the reward of their patient industry. A

number of companies hold shale interests in Tasmania to-day, one of which, the Australian Shale Oil Company, has erected a very large plant, and has opened another area for mining. It is expected that the plant will be put into operation this month. If crude oil can be produced from the great shale deposits of Tasmania by the utilisation of the Bronder process as cheap as the average cost of production of drilled wells, then the operation on a large scale of the shale deposits must prove a very attractive proposition and one which must command attention in the very near future.

There is, as will be shown later, a genetical association between the two important types of oil-producing shale in Tasmania; therefore, one is regarded as an indication of the near presence of the other, yet the two are never found superimposed. Investigation shows that the shales are found in disconnected basins situated in the north and north-central parts of Tasmania, associated with kerogenite and humic-kerogenite coals. The most important is that extending from Latrobe to Quamby Bluff and Chudleigh. From Latrobe the seam has been traced to Railton, Nook, Parramatta, Kimberley, Deloraine, Osmaston, Beulah, Cheshunt, and Chudleigh. Outcrops are found in each area named. From Latrobe the seam has been traced without serious interruption under the broad flood-plain and valley sides of Mersey River to a point three miles south-east of Kimberley. Between Kimberley and Deloraine the shale series of rocks are covered with basalt lava and ash, but they reappear again a mile south of Deloraine, and are well exposed at Osmaston. Remote from these are the Cam River bed of tasmanite, exposed near Henrietta and Oonah, and the so-called torbanites of Preolenna and Mt. Pelion. The Henrietta tasmanite and Preolenna torbanite (kerogenite and humic-kerogenite coals) are directly connected, but the Mt. Pelion seam is far distant, and apparently lies at a slightly higher horizon in the formation than the others.

GEOLOGICAL HORIZON.

The tasmanite shale seam and the associated bed of coal lie at the same horizon in the Permo-Carboniferous formation. In the coal portion of the basins land and freshwater beds are intercalated between Lower Marine and Upper Marine mudstones; but in the tasmanite portion the Lower Marine and Upper Marine form a continuous series uninterrupted by land or freshwater deposits. Long it

was doubtful whether the shale and coal seams were homologous, but recent investigation sets all doubt aside. Early observers noted that in the marine beds above the coal seam fossils are found similar to those in the beds above the shale (tasmanite), and below the shale pebbly mudstone passing down into a basal conglomerate prevails just as happens below the coal seam. The fossils above and below the bed of shale and coal are identical, and all are marine or open estuarine. In boring for oil shale near Latrobe it was found that there is an intergraduation from shale to coal. At Nook the bed of shale abuts against the coal seam on two sides. In the bed of Don River below Bott Gorge is a thick seam of black coaly shale which differs in many important particulars from tasmanite, and apparently marks the transition between it and the humic-kerogenite coal of the region, for, in addition to sporangia of tasmanite, it contains black coaly matter derived probably from another order of plants. The Don Valley black shale cannot be lighted as readily as tasmanite, but the characteristic odour of the latter is given off in burning. Even with the aid of the microscope the structure of this material cannot be perceived. It is interesting to note that the shale layers are separated here as elsewhere by a band of almost barren mudstone.

At Chudleigh, not far from the Cheshunt bed of tasmanite, coaly matter similarly charged with sporangia has been found. In further confirmation, the writer has found thin bands of coal, brittle and of pitch-like lustre, encased in or attached to tasmanite shale at Latrobe. It is noteworthy that the relative proportion of volatile hydrocarbons to fixed carbon is 1 to 1 in this coal as in the main body of coal in the fields of Spreyton, Tarleton, and Dulverton. It is remarkable that where tasmanite is nearby torbanite is not found in direct association with humic-kerogenite (cannel) coal. Yet torbanite-like shales are found below Bott Gorge and at Chudleigh replete with the sporangia of tasmanite. The inference is that sporangia of the marine deposit tasmanite are one of the chief components of torbanite with, perhaps, a far larger proportion of pollen. There is also an intergradation of torbanite to cannel (humic-kerogenite) coal as there is from tasmanite to cannel coal. The gradations may be expressed in the following degrees—tasmanite, black carbonaceous shale of Don Valley class, torbanite or kerosene shale, cannel or humic-kerogenite coal.

THE SHALE BED.

The tasmanite seam is 5 to 7 feet thick, and lies at or about the horizon of the coal bed in contiguous areas. Only one seam of tasmanite and only one seam of coal is known where the two are closely connected. There is no evidence to show that tasmanite and coal are anywhere mutually superimposed; on the contrary, it is known that where coal is found it is futile to search for tasmanite, and where tasmanite is found, for coal. This knowledge facilitates exploration considerably by the elimination of all coal areas from examination. It has been established that the seam of tasmanite fringes the shore-line of the Permo-Carboniferous sea, from which it follows that where the upper marine mudstones abut early Palæozoic and Proterozoic rocks the presence of tasmanite may be anticipated.

A rather striking feature is that there is no noticeable thinning of the seam as the shore line is approached. This is due in part to the steep slope of the shore rock and to the fact that the materials of which the shale is composed were deposited in waters not less than 10 feet deep. The arenaceous muds and sporangia forming the bed of shale were deposited in shallow waters along the shores of islands or in estuaries. It is noteworthy that the shale bed in every locality consists of two main layers separated by a band of mudstone, one to two feet thick, similar to that in which the shale is encased, thus indicating similar conditions of formation and direct association. The separating mudstone band contains tasmanite sporangia, but the roof and floor mudstone are almost devoid of them. Embedded in the shale are numerous well-rounded pebbles and boulders of quartzite, conglomerate, chert, schist, and quartz, many very pyritic. These large inclusions vary in size from marbles to boulders two feet in diameter. The large boulders are subangular and evidently were precipitated into the sea from nearby shore hills. Where the shale enwraps the pebbles and boulders it appears more compressed and closely laminated. In many places the calcite of the marine fossil has been completely replaced by pyrite. Secondary pyrite is abundant also in the rock pebbles and nodules, and veinlets are not uncommon in the body of the shale. The nature of the discs in the shale was discovered by R. M. Johnston, and was first recorded by him in *Field Memoranda for Tasmanian Botanists*, published in 1874. Johnston states that "tasmanite is the product of "the spores and sporangia of certain crytogams allied to the "club-mosses, and that the sporangia were washed down by

"an ancient muddy river and deposited in the quiet bottom "of an inlet of the Upper Palæozoic sea, and among the "sediments thus deposited marine organisms lived and died."

The following is an incomplete list of the marine fossils that have been found in the shale:—

Spirifera tasmaniensis (Morris).
Cardiamorpha gryphoides (De Kon).
Pachydomus hobartensis (Johnston).
Pleurotomaria morrisiana (McCoy).
Pleurotomaria woodsii (Johnston).
Pteronites latus (De Kon).
Aviculopecten latrobensis (Johnston).
Aviculopecten subquinquelineatus (McCoy).
Aviculopecten fittoni (Morris).
Aviculopecten sprentii (Johnston).
Eurydesma hobartense (Johnston).
Keeneia twelvetreesi (Dun).
Orthotites (Fischer).

NATURE OF TASMANITE.

Tasmanite, like kerogenite and humic-kerogenite coals (the so-called kerosene shale and cannel), is not an oil-bearing but an oil-producing substance, that is to say, there is no free oil in the material. That marks the distinction between oil shale and oil sands. In oil sands the oil is contained in the sand as oil. In shale there is no oil as such, but the substance is in it from which oil can be generated. Oils cannot be extracted from it by solvents nor by subjecting the material to high pressure, but oils can be formed from it by the application of heat under suitable conditions. The source of the oil is an organic substance called "Kerogen," with which the shale is impregnated. This organic material is of vegetable origin, and may be regarded as a concrete fixed oil. Yet, it does not follow that there is any direct relation between natural petroleums and the kerogenous materials of oil shale. In fact, it is generally believed that natural petroleums are not of vegetable origin. Shale is essentially a mineral product consisting largely of hardened arenaceous muds, in which are embedded certain fossil hydrocarbons not uncommonly found in the Permo-Carboniferous formation. Kerogenous shales are found in the Permo-Carboniferous of

many countries, and also in later formations. They differ considerably, the difference being due largely to the variation in the conditions under which they were laid down and preserved and to variation in the nature of the plant remains of which they were formed. Some are marine deposits, others are terrestrial; some consist largely of the waxy covering of spore cases, some of pollen and other plant remains in addition. The kerogenous material of tasmanite, so adapted to the generation of artificial petroleum by distillation, consists of the waxy covering of minute disc-shaped spore cases, which are set in a fine-grained arenaceous sediment. The amber-coloured discs or sacs are about half a millimetre in diameter, and, if not deformed, are nearly circular in outline. They appear as flattened bodies pressed together in overlapping layers, and can be separated easily by the insertion of a sharp instrument between them. Under the microscope they appear contorniate, the harder rim part being marked in most cases by black carbonaceous material. Twelvetrees presents the following description: "In trans-"mitted light they are transparent, with a peripheral ex-"ternal wall crowded with rod-like wedge or gash-shaped "cavities of minute size, disposed for the most part sub-"radically within each sac or spore case, and suggestive of "the presence of some cellular structure, faint traces of which "are occasionally revealed." The spore cases have been preserved by a decay-resistant waxy or resinous substance forming the outer skin, but the spores have decayed, and their remains are generally almost indistinguishable, except for a little black carbonaceous material marking the division between the cutaneous waxy covering. However, the nature of the spore sac is clearly revealed in the less deformed specimens. The sporangites or wax-like spore exines (walls) compose the bulk of the oil-producing material, and represent the protective covering of the spores of a plant probably of lycopod relation and allied to present day club-mosses. It is pointed out by Johnston that the spores, evidently, had been discharged, as almost every sac appeared to be fractured as if rent asunder by internal force. These waxy or resinous products of the plant are hydrogen-rich and oxygen-poor substances. The kerogen of these shales, then, consists of the sporangia or spore cases of a supposed lycopodiaceous plant termed by Professor Newton, of the British Museum, *tasmanite punctatus*. The structure of modern club-mosses (lycopods) furnished a feasible explanation of the origin and nature of the fossil remains.

Stewart, a Scottish investigator, obtained a substance similar to shale oil by the distillation of a mixture of 25 per cent. lycopodium spore dust and 75 per cent. of fuller's earth.

PHYSICAL PROPERTIES OF TASMANITE.

Colour—Light yellow or amber when fresh; dark brown on exposed surfaces, grey on weathered surfaces. Lustre—Resinous to pearly. Texture—Finely laminated fissile; weathered shale splits into thin flexible paper-like sheets. Fracture—The material is tough and sectile. It breaks unevenly and with great difficulty across the plane of bedding. Weathering—The shale withstands weathering remarkably, and exposures stand out prominently from the encasing mudstone. The effect of weathering on the oil yield is inappreciable. Specific Gravity—The specific gravity varies from 1.2 to 1.6, the richer layers having the lower value. Hardness—This property varies according to the degree of richness, the average being 1. Flexibility—In thin sheets the shale is capable of being bent through a large arc without breaking. This property is increased by submersion in boiling water. Solubility—Almost, if not quite, insoluble in ether, pyridine, benzine, and carbon bisulphide; unlike ordinary resins and waxes, it is only slightly soluble in alcohol. It is not acted on by HCl; slowly oxidised by HNO_3; readily carbonised by H_2SO_4 with evolution of H_2S. Fusibility—The shale ignites readily with a match, and continues to burn freely when removed from the external source of heat. In burning at that temperature it produces a large volume of black sooty smoke, and gives off a strong unpleasant odour.

CHEMICAL COMPOSITION OF TASMANITE.

When the shale is placed in a retort and subjected to heat, the organic component is progressively decomposed into permanent gases and oil vapours of various kinds, the latter of which can be easily condensed into crude shale oil. The richness of the shale is in proportion to the amount of kerogen it contains or in proportion to the number of sporangia. It is remarkable that although the richness of the shale varies from the top to the bottom of the seam the variation is similar in every shale area, and the average oil content remains constant. The upper part of the seam is richer than the lower in every area, yet the average content of oil in the material as a whole remains between 40 and 45 gallons per ton of shale.

The following proximate analysis of shale from Latrobe area may be taken as a fair indication of the composition:—

Moisture	0.80	per cent.
Volatile Matter	30.84	„ „
Fixed Carbon	5.86	„ „
Sulphur	2.56	„ „
Ash	62.50	„ „

The fixed carbon probably represents the black carbonaceous matter of the sac walls already referred to. A portion of the amount, however, may have been derived from the kerogenous material owing to inefficient distillation. It is possible, for instance, that in the process of distillation and the formation of permanent gases and light gasolene surplus carbon was liberated. Tasmanite is distinguished from many similar plant remains by the high proportion of sulphur it contains in combination with its carbon and hydrogen. The distillate from these shales has the strong penetrating odour of sulphuretted hydrogen and also of carbon bisulphide. Evidently the greater part of the sulphur in that compound represents the amount originally contained in the body of the plant from which the pyrobituminous matter was derived. Extrinsic sulphur in combination with iron as pyrite and marcasite is a common accessory component of the shale, and in the process of conversion of kerogen to oil some of it may have entered into combination with hydrogen and carbon. An ultimate analysis of the crude oil revealed its composition as follows:—

Nitrogen	0.31	per cent.
Hydrogen	10.41	„ „
Oxygen	4.93	„ „
Carbon	79.34	„ „
Sulphur	4.93	„ „

From a number of analyses Church arrived at the empirical formula $C_{40}H_{61}O_2S$, and suggested that the material may be a derivative of turpentine $C_{20}H_{32}$, or the radicle he assumed them to contain may be a homologue of benzoyle $C_7H_5O + 13\ CH_2 = C_{20}H_{31}O$. It is doubtful whether the kerogen of tasmanite can be expressed as a definite chemical compound; the relative proportion of the constituents, however, can be expressed as a constant if sulphur is disregarded. The calorific value of the crude oil has been estimated at 21625 to 21336 B.T.U.; the flash-point from 235 deg. to 260 deg.; and the specific gravity from

0.931 to 0.956. The crude oil remains fluid at the lowest natural temperature of the atmosphere. In the process of distillation the following products are obtained:—

Permanent gases and gasolene ..	10.00	per cent.
Benzine	10	„ „
Fuel oil	80	„ „

By fractional distillation the fuel oil may be converted into

Lighting oils	25	per cent.
Lubricating oils	30	„ „
Tar	28	„ „

The viscosity of the lubricating oil has not been determined, but apparently it is not high, and the oil is not of standard quality. The fuel oil may be used to advantage in internal combustion engines, or as a fuel for the generation of steam, or it may be "cracked" into benzine and residual tar. The oil derivable from tasmanite is of asphaltic base, whereas that from the so-called torbanite and pelionite shales is of paraffin base. The nitrogen content of tasmanite is so small that it may be disregarded. However, it may prove of some value as a fertilising agent if discharged as a constituent of ammonium sulphate into the spent shale which contains other components of plant food. Tasmanite contains a small amount of potash and of soda, and a little phosphoric acid. Applied as a poor fertiliser, the spent shale may prove of some value also as a mechanical agent in breaking up the stiff basaltic soils of the neighbourhood. The following is an analysis of spent shale:—

Carbon	11.0	per cent.
Titania	0.40	„ „
Soda	1.57	„ „
Potash	1.93	„ „
Silica	64.80	„ „
Alumina	12.02	„ „
Ferric oxide	3.58	„ „
Lime	1.00	„ „
Magnesia	1.74	„ „

QUANTITY OF SHALE AVAILABLE.

In all the explored areas sufficient data are available for accurate calculation of the shale reserve. There are, however, certain untested areas in addition which are re-

garded as potential sources of shale, and, therefore, deserve attention. The total tonnage of shale in the several areas is estimated as follows:—

Actual Reserve.	Probable Reserve.
17,000,000	27,000,000

UTILISATION.

The first question for consideration is whether it is advisable to market the fuel oil portion as such, or whether it is advantageous to crack the fuel oil into benzine and tar. In this connection it will prove of interest to note the results of researches performed by Dr. Gustav Egloff, of Chicago, on anti-knock motor fuels. To begin, it may be stated that one of the most important problems in the oil industry to-day is the production of anti-knock motor fuels. Normal straight-run gasolines produced from some oil fields develop the familiar knocking sound in an automotive engine when labouring on hills, with wide-open throttle. For many years it has been believed that straight-run gasolines from paraffin base or semi-asphaltic base oils were superior motor fuels. Since, however, the advent of the commercial cracking of heavy oils into cracked gasolene this position is no longer tenable, for the cracking reaction can be so controlled that anti-knock motor fuels can be produced of superior qualities to straight-run gasoline. Paraffin hydrocarbons vaporised with air detonate with an explosion velocity far beyond that of the normal burning wave. The high velocity of explosion gives a hammer-blow in the cylinder instead of propulsive force, and the high explosion wave gives rise to the familiar sound of knocking in the motor engine when operating at low speed when the motor is on an ascending grade.

The napthene hydrocarbons in gasoline have anti-knock properties which enhance their value, and the aromatic series are so particularly endowed that they are the best compounds derivable from crude oils. The unsaturated hydrocarbons of the clefin series are excellent anti-knock compounds and have important qualities for that reason as motor fuels.

Tests have shown that the straight-run benzine and the cracked fuel oil derived from tasmanite contain oils of the aromatic series, and that the benzine so produced has proved an excellent motor fuel.

STUDIES IN TASMANIAN SPIDERS.

Part I.

By

V. V. Hickman, B.Sc. (Tas.).

Plates IV. to X. and Twenty Text Figures.

(Read 11th October, 1926.)

The following paper deals with material collected in both the north and the south of Tasmania. Six new species are described. Among the *Aviculariдæ*, two very interesting genera are represented, namely *Migas* and *Hexathele*, both of which are typical New Zealand genera.

Family AVICULARIDÆ.

Sub-Family Miginæ.

Genus *Migas* (L. Koch).

The type of this genus is *Migas paradoxus* (L. Koch) (1), found in New Zealand. A mutilated spider collected by the Horn Scientific Expedition to Central Australia (2), and identified by H. R. Hogg as probably *Migas paradoxus*, is the only specimen of this genus recorded from Australia. Owing to the imperfect condition of the specimen it could not be identified with certainty, and considerable doubt exists as to whether the genus does occur in Australia. Goyen (3) has described other New Zealand species belonging to this genus, and recently Berland (4) has recorded a specimen from New Caledonia. It is therefore of interest to record the occurrence of the genus *Migas* in Tasmania. The following description deals with a new species from this State. The name *Migas nitens* is suggested on account of the shiny appearance of the cephalothorax.

Migas nitens (*sp. nov.*).

Plate IV.

The description of the female is as follows:—

Measurements in millimetres (excluding the falces).

Total Length	10.0
Length of Cephalothorax	4.0
Breadth of Cephalothorax (across fovea)	3.7
Length of Abdomen	7.1
Breadth of Abdomen	5.4

Leg	Coxa	Trochanter and Femur	Patella and Tibia	Metatarsus and Tarsus	Total
1	1.6	3.4	3.0	2.1	10.1
2	1.4	3.0	2.8	1.8	9.0
3	1.2	2.8	2.6	2.3	8.9
4	1.6	3.9	4.3	3.0	12.8
				Tarsus	
Palpi	1.5	2.3	1.9	1.2	6.9

Cephalothorax: Shining, brown, hairless, moderately arched, slightly longer than broad.

Pars Cephalica: Gently ascending. A pair of conspicuous erect bristles stand one on each side of the centre line in front of the fovea. A row of three or four shorter bristles in single file extends from the ocular area about a third of the way along the middle line towards the fovea. The segmental groove is distinct, and near its posterior end on each side is a deep pit.

Ocular Area: Dark brown, more than twice as broad as it is long. Immediately behind each front median eye there is a long bristle curved forward over the eye, while rising from a point between these eyes is a single long erect bristle.

Clypeus: Wide, the front median eyes being removed from the margin by a distance equal to twice the diameter of one of these eyes. The surface is covered with fine transverse wrinkles, and there is a tuft of bristles before the front median eyes.

Pars Thoracica: Arched and sloping steeply down from the thoracic fovea to the posterior margin; devoid of hairs and bristles; radial grooves not well defined.

Thoracic Fovea: Deep, strongly recurved, and elevated so that its rim is not much lower than the highest point of the *pars cephalica.*

Marginal Band: Slightly reflexed, dark brown in colour. No distinct fringe is present, but a few isolated small hairs are visible.

Eyes: The eye space occupies more than half the width of the front of the cephalothorax. The eyes are in two rows. If viewed from above the front row appears straight, but viewed from in front it is seen to be procurved. The

rear row is recurved and shorter than the front row. The front median eyes are on a slight elevation. They are round and separated from each other by a distance equal to their individual diameter. The front laterals are poised obliquely and are the largest of the group. Each has a long diameter equal to slightly more than one and a half times the diameter of a front median eye, and the same distance separates its nearest point from its front median neighbour. The rear laterals are the smallest of the group, and each has a long diameter equal to about three-quarters that of a front median eye. The long diameter of a rear median eye is a little less than one and a half times the diameter of a front median eye. The rear median eyes are separated from each other by three and a half times the diameter of a front median eye, and each from the nearest point of its lateral neighbour by a little more than half the diameter of a front median eye. The distance separating the nearest points of the front and rear laterals of the one side is about equal to the diameter of a front median eye. The lateral eyes are on prominent black mounts, which make them appear larger and nearer to the other eyes than they actually are. (See Fig. 1.)

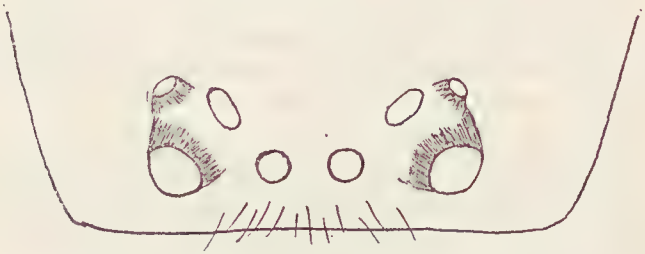

Fig. 1. *Migas nitens* (*sp. nov.*). Eyes in female.

Legs: Relative lengths, 4, 1, 2, 3; shining, concolorous with the cephalothorax, no scopula present. Femoral segments 1 and 2 are bowed. Tibial and metatarsal segments 1 and 2 armed with powerful curved spines on both the inner side and the outer side. On the outer side the spines are arranged in an irregular double row. (See Fig. 2.) The number and arrangement of the spines vary in different individuals of this species. Legs 3 and 4 are not very spiny, there being only one small spine on the outer side of the patella, and one on the outer side of the metatarsus of 3, and three small spines on the outer side of the metatarsus of 4. In the case of legs 1, 2, and 3, the superior tarsal claws

have a single tooth, while leg 4 has two teeth on the outer superior claw and none on the inner claw. All the inferior claws are small and bare.

Fig. 2. *Migas nitens* (*sp. nov.*) ♀. Outer side of tibia and metatarsus I.

Palpi: Concolorous with the legs; femoral segment bowed. On the inner side of the patella there is a single large spine pointing downwards and inwards. (See Fig. 3.) The tibia usually has two short spines on the inner, and two on the outer side, while the tarsus is armed on both sides with powerful curved spines resembling those on legs 1 and 2. The single tarsal claw has one or two pectinations near the base.

Falces: Short, dark brown, shining; the horizontal surface is almost bare, the front surface clothed with bristles but without a rastellum. Fang well curved, strong, serrated, and reinforced with ridges as in *Heteromigas dovei* (Hogg). There are three large teeth on inner edge of furrow and six smaller teeth on the outer edge; no intermediate teeth are present.

Maxillæ: Light brown in colour; furnished with a beard of long reddish hairs along the inner margin, and with short spines extending over a somewhat central area from heel to apex.

Labium: A darker brown in colour than the maxillæ; arched, apex rounded, furnished with about 20 short spines and with long bristle-like hairs; separated from the sternum by a groove.

Fig. 3. *Migas nitens* (*sp. nov.*). Left palpus of female from above.

Sternum: Light brown, broadly pyriform, arched, thinly clothed with short black hairs.

Sigilla: Posterior pair are large and about as far from the margin as from the centre. Other sigilla are small, indistinct, and marginal.

Abdomen: Ovate; anterior portion overhangs the base of the cephalothorax; upper surface dark brown, thinly clothed with short hairs; under surface lighter in colour.

Spinnerets: Short, stout, yellowish, hairy. In the case of the superior pair the first joint is twice the length of the second, while the third joint is very small and dome shaped. Inferior pair are twice as long as broad, and separated by once their individual diameter.

Locality: Prince of Wales Bay, Derwent Park; and Cornelian Bay, New Town. 30th December, 1925.

Field Notes: At both the localities mentioned above the nest was made in an embankment near the shore. The burrow, which is only about 40 mm. deep, goes down at a

Fig. 1. *Migas nitens* (*sp. nov.*) ♀.

Fig. 2. *Migas nitens* (*sp. nov.*).
Vertical section through burrow showing spider guarding eggs.

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slight incline from the vertical. It is lined throughout with a thick strong layer of silk, and closed with a neatly-fitting lid. Several burrows were found to be sealed up. On opening them the spider was discovered guarding her eggs. The latter, about ten in number, are not enclosed in a sac, but simply grouped together and fastened to the side of the burrow with a few strands of silk. They are placed near the bottom of the nest. (See Plate IV., Fig. 2.)

Sub-Family CTENIZINÆ.

Genus *Arbanitis*, L. Koch.

Arbanitis scaurus, sp. nov.

Plate V.

The description of the male is as follows:—

Measurements in millimetres (excluding the falces).

Total Length	14.0
Length of Cephalothorax	7.5
Breadth of Cephalothorax	6.5
Length of Abdomen	6.5
Breadth of Abdomen	5.0

Leg	Coxa	Trochanter and Femur	Patella and Tibia	Metatarsus and Tarsus	Total
1	3.5	8.0	8.0	10.0	29.5
2	3.0	8.0	8.0	9.0	28.0
3	2.5	6.5	6.0	8.0	23.0
4	3.0	8.5	9.5	11.0	32.0
				Tarsus	
Palpi	3.0	4.5	5.5	1.5	14.5

Cephalothorax: Obovate, dark brown, moderately clothed with long, yellowish, down-lying hair.

Pars Cephalica: Arched, gently ascending; segmental groove well marked; devoid of hair along the middle line, but provided with a row of black bristles.

Ocular Area: About one and a half times as broad as it is long, arched, raised, and with a group of eight or nine black bristles in front.

Clypeus: Narrow, hyaline, sloping forward.

Pars Thoracica: Arched, moderately broad, gently sloping to the rear; radial grooves well marked.

Thoracic Fovea: Deep and straight.

Marginal Band: Very narrow, fringed with coarse black bristles.

Eyes: In two rows; front row strongly procurved, rear row recurved. The front median eyes are round and somewhat raised. They are separated from each other by a space equal to slightly less than one-third of their own individual diameter, and from the front laterals by about twice this distance. Both the front and the rear laterals are elliptical and poised obliquely. The rear laterals are slightly smaller than the front laterals, which have a long diameter equal to about one and a third times the diameter of a front median eye. The distance which separates the lateral eyes of the same side is equal to that which separates the front laterals from the front medians. The long diameter of the rear medians is slightly less than the diameter of the front medians. They are close to the rear laterals, but do not actually touch them. (See Fig. 4.)

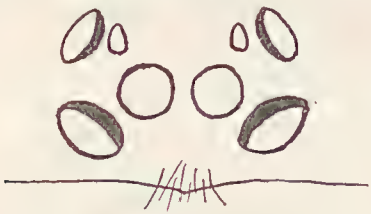

Fig. 4. *Arbanitis scaurus (sp. nov.)*. Eyes in male.

Legs: Relative lengths, 4, 1, 2, 3. Concolorous with the cephalothorax, clothed with light brown hairs and coarse black bristles. Tarsi I. and II. are devoid of spines, but possess a scopula which extends half way along the metatarsus. All the metatarsi and tibiæ are bespined. Metatarsus I. is slightly bowed. Tibia I. is armed with two apophyses near the apex. The upper one is broadly bifurcated, one prong consisting of three short blunt teeth close together, while the other prong consists of a single sharp tooth bent at right angles. Between the two prongs there is a short spine. The lower apophysis is longer than the upper one and ends in a row of four blunt teeth curved inwards. (See Fig. 5.) On the upper side of each leg, particularly on the tibia, metatarsus, and tarsus, between the bristles, there is an irregular row of small tubercles. In the top of each tubercle there is a cup-like depression from the centre of which rises a thread-like hair, longer and finer than any of the other hairs on the legs. It was noticed that in a freshly killed spider these fine hairs were swayed by the slightest movement of the air, whereas the other hairs remained motionless.

The superior tarsal claws have seven teeth, five teeth being close together near the base of the claw, and two teeth on the side of the claw towards the apex. Inferior claw is bare.

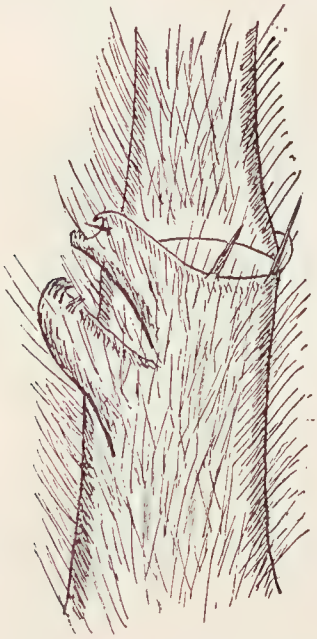

Fig. 5. *Arbanitis scaurus* (*sp. nov.*). Apex of tibia I. of male from below.

Palpi: About half the length of leg I., hairy, concolorous with the legs; tibial segment very much inflated and furnished with an apophysis thickly covered with spines. Bulb pyriform, bilobed, shining, produced into a very short, flat, and twisted style. (See Fig. 6.) The tarsal segment is small.

Falces: Small, black, clothed with black bristles; furnished with a well formed rastellum. The fang is curved, shining, and dark reddish brown in colour. The inner margin of falx sheath is armed with teeth, the outer margin thickly fringed with long yellow hair.

Maxillæ: Dark brown, inner edge fringed with yellow hair. There is a small cluster of spines at the lower inner corner.

Labium: Submerged; slightly longer than broad, a few black bristles at the apex, but no spines are present.

Sternum: Pyriform, dark brown, clothed with short bristles.

Sigilla: Posterior pair not large and placed near the margin. The others are indistinct.

Fig. 6. *Arbanitis scaurus* (*sp. nov.*). Palpus of male.

Abdomen: Dark brown, clothed with long black slender setæ and short yellowish hairs on the upper surface. The lower surface is similarly clothed, but the setæ are short. On the upper surface is an indistinct pattern resembling that on the female (see below).

Spinnerets: Short, yellowish-brown, hairy. The first joint of the superior pair is the longest and equal in length to the other two combined. Inferior pair very small, cylindrical, and separated from each other by a space equal to once their individual diameter.

The description of the female is as follows:—

Measurements in millimetres (excluding the falces).

Total Length	21.0
Length of Cephalothorax	10.0
Breadth of Cephalothorax	7.5
Length of Abdomen	11.0
Breadth of Abdomen	7.5

Leg	Coxa	Trochanter and Femur	Patella and Tibia	Metatarsus and Tarsus	Total
1	4.5	9.0	8.0	6.5	28.0
2	4.0	7.5	7.0	6.0	24.5
3	3.5	6.0	6.0	5.0	20.5
4	4.0	8.0	10.0	8.0	30.0
				Tarsus	
Palpi	4.0	6.5	6.0	3.5	20.0

Cephalothorax: Obovate, dark brown, moderately clothed with long yellowish down-lying hair as in the male.

Pars Cephalica: Arched, gently ascending, segmental groove distinct. Along the middle line from eye space to fovea there is a row of black bristles standing out from a band of yellow hair, on each side of which there is a bare strip.

Ocular Area: One and two-third times as broad as it is long, raised, arched, and provided with a few short bristles in front.

Clypeus: Wide, hyaline, sloping forward, transversely wrinkled.

Pars Thoracica: Arched, moderately broad, sloping to the rear, radial grooves distinct.

Thoracic Fovea: Large, deep, and straight.

Marginal Band: Wide, hyaline, undulating, fringed with black bristles.

Eyes: In two rows. Front row strongly procurved, rear row recurved. The round front median eyes are somewhat raised. They are separated from each other by a space equal to a little more than two-thirds of their individual diameter, and from their lateral neighbours by a space nearly equal to their individual diameter. The front and rear laterals are elliptical, poised obliquely, and separated from each other by a space equal to the long diameter of a rear lateral. The front laterals are the largest of the group, their long diameter being equal to twice the space separating the front median eyes. The rear medians are the smallest of the group, being slightly smaller than the front medians. They are separated by a space equal to three times that which separates the front median eyes. They are close to but do not touch their lateral neighbours. (See Fig. 7.)

Legs: Relative lengths, 4, 1, 2, 3; light brown in colour. Tarsus I. and three-quarters of metatarsus I. thickly scopulated. Tarsus II. and half metatarsus II. also thickly scopulated. The other tarsal and metatarsal segments not scopulated. Tarsus I. is devoid of spines, tarsus II. has two small

spines on the outer side. The other tarsi and all metatarsi and tibiæ are well armed with spines. Patella III. has three short spines on the outer side. All other segments are

Fig. 7. *Arbanitis scaurus* (*sp. nov.*). Eyes in female.

devoid of spines. The legs are lightly clothed with coarse black bristles and a little hair similar to that on the cephalothorax. The fine thread-like hairs noticed in the male are also present in the female. The superior tarsal claws have four teeth, a large tooth and a minute tooth being near the base of the claw, and two teeth on the side of the claw towards the apex. The inferior claw is bare.

Palpi: Long, being almost equal in length to the third pair of legs. Similar in colour and clothing to the legs. Tarsus is thickly scopulated. The single tarsal claw has a minute tooth near the base, and close to it a large tooth separated by a space from two medium-sized teeth.

Falces: Black, strong, clothed with black bristles in front and provided with a rastellum. The fang is well curved, long, shining, and black. Inner edge of falx sheath armed with a row of eight large teeth, outer edge provided with a thick fringe of long yellowish hair. There is an intermediate row of six minute teeth near the base. The number and arrangement of the teeth vary in different individuals.

Maxillæ: Dark brown, hairy, inner edge fringed with long reddish brown hair. A few small spines are placed at the lower inner angle.

Labium: Submerged, hairy, rounded in front, devoid of spines.

Sternum: Pyriform, dark brown, clothed with black bristles, curved in front round the base of the labium.

Sigilla: Posterior pair are not very large. They are placed near the margin. The others are indistinct.

Abdomen: Obovate, yellowish brown underneath, dark brown above. Clothed with short hairs interspersed with

isolated long hairs. On the sides are a few scattered dark brown spots; from the centre of each spot projects a long hair. On the upper surface a faint pattern is visible (more distinct in alcohol). It consists of a light brown central spot near the anterior end, with a smaller spot on each side. Behind these are ten faint bars arranged five on each side.

Spinnerets: Short, yellowish brown, hairy. First joint of the superior pair slightly longer than the second and third joints combined. The second joint is twice the length of the third joint, which has a rounded tip. The inferior pair are very small and separated by a space equal to once their individual diameter.

Locality: Westmoreland Falls, Mole Creek. 5th April, 1926.

Observations: Rainbow and Pulleine (5) have given a table in elucidation of the known Australian species of the genus *Arbanitis* (L. Koch). The table includes one Tasmanian form, namely *Arbanitis maculipes* (Hogg) (6), and eleven other species.

Field Notes: The male of *Arbanitis scaurus* was found under a log. The female makes a burrow in the ground, in rotten logs, or in fern stumps. The burrow is lined with silk and is not provided with a lid.

Sub-Family DIPLURINÆ.

Genus *Atrax* (O. P. Cambr.)

Atrax venenatus, sp. nov.

Plate VI.

The description of the male is as follows:—

Measurements in millimetres (excluding falces).

Total Length	16.0
Length of Cephalothorax	8.0
Breadth of Cephalothorax	6.5
Length of Abdomen	9.0
Breadth of Abdomen	6.5

Leg	Coxa	Trochanter and Femur	Patella and Tibia	Metatarsus and Tarsus	Total
1	3.6	7.0	7.0	7.0	24.6
2	2.9	6.5	6.5	6.5	22.4
3	2.5	5.9	5.5	6.9	20.8
4	3.0	6.7	6.7	8.0	24.4
				Tarsus	
Palpi	3.2	4.0	4.0	1.3	12.5

Cephalothorax: Very dark chocolate brown in colour, arched, shiny, longer than broad.

Pars Cephalica: Moderately high, sloping gently to the thoracic fovea, lightly clothed with a few scattered black hairs. A median row of bristles extends from the eye space to the fovea, and on each side of this is a shorter parallel row. Segmental groove is distinct.

Ocular Area: Black, raised, twice as broad as long.

Clypeus: Moderately wide, transversely wrinkled, hyaline, furnished with a tuft of short bristles below the front median eyes.

Pars Thoracica: Arched, sloping gently to the rear; radial grooves deep and well defined.

Thoracic Fovea: Deep and strongly procurved.

Marginal Band: Broad, reflexed, brown, fringed with a few isolated hairs.

Eyes: Arranged in two rows. The front row is procurved and the rear row is recurved. The front median eyes are the smallest of the group, and are separated by a space equal to one and one-third times their individual diameter. The long diameter of a front lateral eye is equal to twice the diameter of a front median eye. A space equal to half the diameter of a front median eye separates each front lateral from its median neighbour. Each rear median eye has a long diameter slightly greater than the diameter of a front median eye. The long diameter of a rear lateral is equal to one and one-third times the diameter of a front median eye. The rear median eyes are separated from each other by a space slightly more than three times the diameter of a front median eye. A space equal to the long diameter of a rear median eye separates the front and rear laterals. (See Fig. 8.)

Fig. 8. *Atrax venenatus* (*sp. nov.*). Eyes in male.

Fig. 3. *Arbanitis scaurus* (*sp. nov.*) ♂.

Fig. 4. *Arbanitis scaurus* (*sp. nov.*) ♀.

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Legs: Relative lengths, 1, 4, 2, 3; concolorous with the cephalothorax, tapering, moderately strong. No true scopula is present. All the tarsal, metatarsal, and tibial segments are armed with spines. In the case of tibia I. the whole length of the under surface is heavily spined, likewise the basal half of the under surface of tibia II. (See Fig. 9.)

Fig. 9. *Atrax venenatus* (*sp. nov.*). Tibia II. of male from underneath.

One or two spines are present on femoral segments I. and II., also on patellæ I. and II. The superior tarsal claws are provided with a row of about 13 teeth running diagonally across the claw. The inferior claw is small and bare.

Palpi: Concolorous with the legs, rather short and hairy. The femoral segment is bowed and possesses one or two spines at the apex on the upper side. Patella is also armed

with one or two curved spines. The tibia is furnished with about nine spines, five of which are near the apex. The tarsus is deeply cleft. The genital bulb is pyriform, and is produced into a long, thin, somewhat flattened style, which is slightly twisted and ends in a spatulate point. (See Fig. 10.)

Fig. 10. *Atrax venenatus* (*sp. nov.*). Palpus of male.

Maxillæ: Brown, hairy, most of the surface covered with small spines, inner fore angle ends in an obtuse point.

Labium: Free, concolorous with the maxillæ, arched, as broad as long, densely covered with small spines, provided in front with long hairs and bristles.

Sternum: Shield-shaped, slightly darker in colour than the maxillæ, clothed with black bristles.

Sigilla: Large and distinct. The anterior pair marginal, the other two pairs removed from the margin.

Abdomen: Ovate, brownish black in colour, clothed with long black bristles and short black hairs. The anterior portion slightly overhangs the base of the cephalothorax.

Spinnerets: Brownish yellow, short and hairy. The superior pair tapering, first and third segments equal in length and twice as long as the second segment. Inferior spinners small, cylindrical, and about once their individual transverse diameter apart. Anal tubercle is conspicuous.

The description of the female is as follows:—

Measurements in millimetres (excluding the falces).

Total Length	18.0
Length of Cephalothorax	7.5
Breadth of Cephalothorax	6.5
Length of Abdomen	11.5
Breadth of Abdomen	9.5

Leg	Coxa	Trochanter and Femur	Patella and Tibia	Metatarsus and Tarsus	Total
1	3.0	6.0	6.0	6.0	21.0
2	2.7	5.5	5.5	4.5	18.2
3	2.5	4.5	4.5	4.5	16.0
4	2.5	6.0	5.0	6.0	19.5
				Tarsus	
Palpi	3.0	4.5	3.0	3.0	13.5

Cephalothorax: Very dark brown, almost black in colour, shining, slightly longer than broad, clothed with a few black hairs scattered over the surface.

Pars Cephalica: Raised, arched, sloping towards the thoracic fovea; furnished with a median row of long thin erect bristles extending from the eye space to the fovea, and on each side of this median row there is a shorter parallel row, as in the male.

Ocular Area: Twice as broad as long, slightly raised, and gently arched. A group of bristles, which slope forward, occupies the space between the rear median eyes.

Clypeus: Narrow, of a vitreous greyish tint, furnished with a tuft of black bristles below the eyes; one long bristle stands out conspicuously from a point in front of and between the front median eyes.

Pars Thoracica: Broad, indented on its rear margin, radial grooves distinct and deep.

Thoracic Fovea: Deep and strongly procurved.

Marginal Band: Narrow, slightly reflexed, yellowish brown, lightly fringed with fine hairs.

Eyes: Front row slightly procurved, rear row recurved. The round front median eyes are the smallest of the group. They are separated by a space equal to nine-eighths of their individual diameter. The elliptical front laterals are poised obliquely. They are the largest of the group. Each has a long diameter almost twice the diameter of a front median eye, and each is separated from its median neighbour by a space equal to the diameter of the latter and from the corresponding rear lateral by three-quarters of that distance. The long diameter of each rear median is equal to nine-eighths of the diameter of a front median eye. The distance between the rear median eyes is equal to three and a half times that between the front median eyes. Each rear median eye is separated by a space equal to one-third of its own long diameter from its lateral neighbour. The long diameter of a rear lateral is slightly greater than that of a rear median eye. (See Fig. 11.)

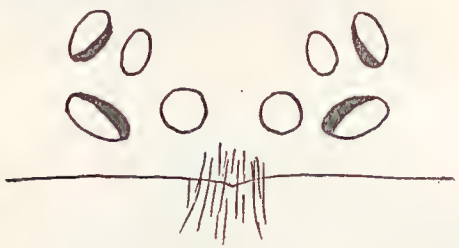

Fig. 11. *Atrax venenatus* (*sp nov.*). Eyes in female.

Legs: Very dark brown, moderately strong, tapering, clothed with long black bristles and hairs. Relative lengths, 1, 4, 2, 3. All the tarsi and metatarsi are bespined. Tibiæ I., II., and IV. have each a single spine on the under side near the distal end. Tibia III. has five spines on the outer side, two on the inner. There are four spines on the outer side of patella III., near the apex. The femoral segments are devoid of spines. Superior tarsal claws have a row of eight pectinations running diagonally across the claw. The inferior claw has two minute teeth near its base.

Palpi: Short, concolorous with legs, clothed with black bristles and hairs. Tarsal segment has five spines on the

inner side, and three on the outer side. Tibia has two spines on the under side near the apex. The other segments are devoid of spines. No true scopula is present. The single tarsal claw has a diagonal row of eight pectinations.

Falces: Concolorous with cephalothorax, strong, clothed with black bristles and hairs. There is no rastellum. Fang is well curved and reddish brown in colour. Outer margin of falx sheath furnished with a row of ten teeth, inner margin with nine, while there is also an intermediate row of thirteen running the whole length of the furrow.

Maxillæ: Brown, arched, divergent, hairy, the inner apical angle ends in an obtuse point. The full length of the inner surface is studded with small spines, which are especially numerous at the base.

Labium: Truncate in front, as broad as long, thickly studded with small spines and clothed with long brown hairs.

Sternum: Shield shaped, brown, clothed with black bristles, excavated in front round the base of the labium.

Sigilla: Large and distinct, the anterior pair marginal, the others removed from the margin.

Abdomen: Ovate, brownish black, clothed with long black bristles and short black hairs. The base of the abdomen slightly overhangs the cephalothorax. In alcohol a faint pattern is seen. This takes the form of three very fine diagonal stripes on each side.

Spinnerets: Short, clothed with yellowish brown hairs. The superior pair have the first joint the longest, the second joint the shortest, while the third joint is slightly shorter than the first joint. The inferior pair are short, cylindrical, with rounded apices and separated from each other by a space equal to once their individual diameter.

Locality: New Town Creek, Hobart. 22nd December, 1925.

Field Notes: This spider is widely distributed in Tasmania. In the south I have taken specimens at the Cascades, at Lenah Valley, across the Derwent at East Risdon, and at New Town; while in the north I have found it at Trevallyn. Mr. A. L. Meston, M.A., was good enough to give me a male specimen, which he took on Ben Lomond, at an altitude of 4,300 feet. The spider is generally found in shady situations, where it constructs a silken tube under stones, among fallen leaves, twigs, or moss. The tube is frequently branched, and at the opening it is sometimes expanded into a network

of threads. Like other members of the genus *Atrax*, the female is of a pugnacious disposition, and strikes viciously when a collecting tube is brought near, while glistening drops of a clear liquid exude from the pore at the tip of the fang. This habit suggested the specific name *venenatus*. Adult specimens show considerable variations in size, some being larger and some smaller than the type specimen described above.

Atrax pulvinator, sp. nov.

Plate VII.

The description of the female is as follows:—

Measurements in millimetres (excluding the falces).

Total Length	17.0
Length of Cephalothorax	7.0
Breadth of Cephalothorax	6.0
Length of Abdomen	11.0
Breadth of Abdomen	9.0

Leg	Coxa	Trochanter and Femur	Patella and Tibia	Metatarsus and Tarsus	Total
1	3.0	5.5	4.5	3.7	16.7
2	2.5	4.5	4.0	3.3	14.3
3	2.5	4.5	3.5	3.0	13.5
4	2.8	5.5	5.0	4.5	17.8
				Tarsus	
Palpi	3.0	4.0	3.0	2.0	12.0

Cephalothorax: Brown, shining, slightly longer than broad.

Pars Cephalica: Arched, well elevated, and sloping steeply to the thoracic fovea; smooth except for a few isolated hairs and a median row of fine bristles running from the eye space to the fovea. Segmental groove well defined.

Ocular Area: Two and a half times as broad as it is long, slightly raised, furnished in front with a tuft of stiff bristles. A long conspicuous bristle stands between the front median eyes and a few shorter ones behind the eye space.

Clypeus: Hyaline, transversely wrinkled, indented at the middle, moderately broad.

Pars Thoracica: Broad, somewhat depressed, indented at its rear margin, radial grooves distinct.

Thoracic Fovea: Deep and strongly procurved.

Marginal Band: Broad, slightly reflexed, fringed with a few long hairs.

Eyes: In two rows; rear row recurved and a little longer than the front row, which is slightly procurved. The round front median eyes are on a slight elevation, and separated from each other by one and a quarter times their individual diameter. The front laterals are the largest of the group, and have a long diameter equal to one and two-thirds the diameter of a front median eye. They are poised obliquely, and each is separated from its front median neighbour by a space equal to half its own long diameter and from its rear lateral neighbour by slightly more than this space. The long diameter of a rear lateral eye is equal to the diameter of a front median eye. The rear median eyes are separated from each other by a space equal to two and two-thirds that which separates the front medians from each other. (See Fig. 12.)

Fig. 12. *Atrax pulvinator* (*sp. nov.*). Eyes in female.

Legs: Relative lengths, 4, 1, 2, 3. Concolorous with cephalothorax, clothed with long black bristles and brown hairs. No scopula is present on any of the legs. All the tarsi and metatarsi are lightly armed with spines. Tibiæ I. and II. possess no spines, but III. and IV. are lightly bespined. On the outer side of patella III. there is a group of ten short spines and one or two on the outer side of patella IV. The superior tarsal claws of legs I. and II. have five teeth in a diagonal row across the claw, and the inferior claw has two teeth. While for legs III. and IV. the superior tarsal claws have one large tooth and three minute teeth, and the inferior claw is bare. Considerable variations in the pectination of the tarsal claws were found to exist in different individuals.

Palpi: Brown, moderately long, the tarsal segment is armed with four spines. The single claw has three teeth close together near the base.

Falces: Large, strong, dark-brown, clothed with stiff bristles. There is no rastellum. Fang is well curved. Inner margin of falx sheath armed with five teeth, outer margin with six. Three small intermediate teeth are also present near the base.

Maxillæ: Light brown, arched, heel rounded; the whole length of the inner area is lightly covered with spines, and coarse hairs. The inner edge is fringed with light brown hairs.

Labium: Light brown, arched, as broad as long, truncated in front and furnished with numerous short spines and long hairs.

Sternum: Brownish yellow, broad, somewhat shield-shaped, clothed with bristle-like hairs. In front it is curved round the base of the labium and terminates on each side in a point.

Sigilla: First and second pairs are sub-marginal, the third pair are large and placed midway between the margin and the centre line.

Abdomen: Obovate, dark brown, hairy.

Spinnerets: Yellowish brown, hairy. The superior pair are tapering, and about one quarter the length of the cephalothorax; the second and third joints are equal in length, the first joint is the longest, being equal in length to the other two combined. The inferior pair are small, cylindrical, with rounded apices and separated by about once their individual transverse diameter. Anal tubercle prominent.

Locality: Cascades, Hobart. 25th December, 1925.

Field Notes: The burrow of this spider was found in soft soil near the bank of a creek. It was about 180 mm. deep and 15 mm. in diameter, and went down almost vertically. It was lined inside with a fairly strong silken tube. This was not attached very firmly to the side of the burrow, and was easily removed. At the surface the silken tube ran along the ground for about 50 mm. underneath a bed of moss. When found the silken tube was closed up, but there was no sign of any lid. Two burrows were found; one contained a beautiful pillow-shaped egg sac, 25 mm. long and 15 mm. broad. This was attached by its four corners to the side of the silk tube just below the surface. (See Plate VII., Fig. 8.)

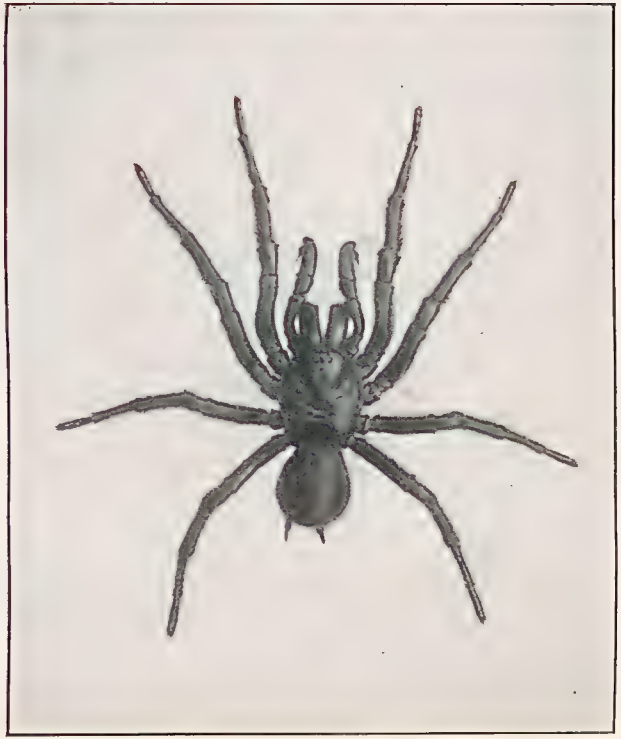

Fig. 5. *Atrax venenatus (sp. nov.)* ♂.

Fig. 6. *Atrax venenatus (sp. nov.)* ♀.

Fig. 7. *Atrax pulvinator* (*sp. nov.*) ♀.

Fig. 8. *Atrax pulvinator* (*sp. nov.*).
Silk tube removed from burrow and side cut open to show egg sac.

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Genus *Hexathele* (Ausserer).

Hexathele montanus, sp. nov.

Plates VIII. and IX.

The description of the male is as follows:—

Measurements in millimetres (excluding the falces).

Total Length	16.5
Length of Cephalothorax	8.5
Breadth of Cephalothorax	7.5
Length of Abdomen	8.5
Breadth of Abdomen	6.0

Leg	Coxa	Trochanter and Femur	Patella and Tibia	Metatarsus and Tarsus	Total
1	4.0	8.5	9.0	11.0	32.5
2	3.5	8.0	9.0	11.5	32.0
3	3.3	7.0	8.5	12.0	30.8
4	3.3	9.0	10.0	14.0	36.3
				Tarsus	
Palpi	3.0	5.0	5.0	1.0	14.0

Cephalothorax: Black, slightly arched, nearly as broad as it is long; almost devoid of hairs.

Pars Cephalica: Not very high, sloping gently to the thoracic fovea. Segmental groove distinct.

Ocular Area: A little more than twice as broad as it is long, slightly arched.

Clypeus: Narrow, black, and provided with a tuft of a few short bristles in front of the median eyes.

Pars Thoracica: Broad, radial grooves well marked, rear margin slightly indented.

Thoracic Fovea: Small, deep, and straight.

Marginal Band: Narrow, fringed with long black bristles.

Eyes: In two rows. Viewed from above the front row is straight, and the rear row recurved. The round front median eyes are separated from each other by a space equal to one-third of their individual diameter, and from their lateral neighbours by the same distance. The front and rear laterals are poised obliquely and separated by a space equal to that which separates the front median eyes. The front laterals are the largest of the group and have a long diameter equal to one and a sixth times that of a front median eye. The long diameter of the rear laterals is equal to the diameter of a front median eye, while that of a rear median eye is

three-quarters of that length. The space separating the rear medians is equal to one and three-quarter times the diameter of a front median eye. (See Fig. 13.)

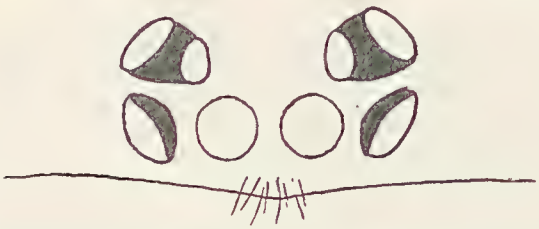

Fig. 13. *Hexathele montanus* (*sp. nov.*). Eyes in male.

Legs: Relative lengths, 4, 1, 2, 3. Long, slender, and tapering; nearly black in colour, except the patellæ, which are brown. The tarsal segment of each leg has a divided scopula, which is not very dense. The division is occupied by a row of short setæ. The legs are well armed with spines on all the segments, except the coxæ, trochanters, and the under side of the femurs. Metatarsus I. is slightly thickened in the centre. Tibia I. is provided with a prominent curved spine rising from a small apophysis on the under side at the apex. (See Fig. 14.) The superior tarsal claws

Fig. 14. *Hexathele montanus* (*sp. nov.*). Tibia I. of male.

have a diagonal row of eleven pectinations and the inferior claw has two pectinations.

Palpi: Concolorous with legs, clothed with long black bristles, but devoid of spines, except for a few on the upper

side of the femoral segment. The bulb is pyriform and is produced into a finely pointed style. The tibial segment is somewhat inflated in its basal half. (See Fig. 15.)

Fig. 15. *Hexathele montanus* (*sp. nov.*). Palpus of male.

Falces: Black, shining, clothed with bristles but without a rastellum. Inner edge of falx sheath armed with a row of about thirteen teeth; the outer edge provided with a fringe of reddish brown hair. Fang black, moderately long, and curved.

Maxillæ: Dark brown, with a reddish brown beard along the inner edge. The inner fore corner terminates in a blunt prominence The heel is well rounded and furnished with spines.

Labium: Slightly longer than broad; dark brown at the apex, black near the base; sides nearly parallel, concave from apex to base, convex from side to side, apex rounded and furnished with a few small spines and long black bristles. Several well marked creases across the base.

Sternum: Black, ovate, broadest between the second pair of coxæ, excavated in front round the base of the labium, clothed with black bristles and hairs.

Sigilla: Moderately large, about equal in size, and placed near the margin.

Abdomen: Obovate, black, with five pairs of faint yellow spots on the dorsal surface. (These spots are more distinct

in young specimens.) Clothed with long black bristles, each rising from a small tubercle. Lung covers yellowish. The front of the abdomen slightly overhangs the base of the cephalothorax.

Spinnerets: Six in number, dark brown in colour. The superior pair are 5 mm. long, and tapering. The third joint is the longest, being twice the length of the second joint and slightly longer than the first joint, which is divided at the rear, and has the appearance of being built up of two segments, but the dividing line is not continued right round the joint. The second pair are short, cylindrical, and rounded at the tip, equal in length to the second joint of the superior pair, and separated from each other by three times their own individual diameter. The third pair are about equal in length to the second pair, short, cylindrical, and concave at the tip. The concavity contains a sunken dome. They are situated outside the second pair, but close to them and a little nearer the front. Anal tubercle prominent.

The description of the female is as follows:—

Measurements in millimetres (excluding the falces).

Total Length	20.0
Length of Cephalothorax	10.0
Breadth of Cephalothorax	8.5
Length of Abdomen	11.0
Breadth of Abdomen	8.5

Leg	Coxa	Trochanter and Femur	Patella and Tibia	Metatarsus and Tarsus	Total
1	4.5	8.5	9.25	9.5	31.75
2	4.0	8.0	8.50	8.0	28.50
3	3.5	7.0	8.00	8.5	27.00
4	4.0	9.0	9.50	11.0	33.50
				Tarsus	
Palpi	4.0	6.5	6.50	4.0	21.00

Cephalothorax: Black, moderately arched, longer than broad, almost hairless.

Pars Cephalica: Moderately high, much more elevated than in the male; segmental groove distinct. There is a row of four or five black bristles in a central line behind the eyes.

Ocular Area: About two and a third times as broad as it is long. Slightly arched.

Clypeus: Dark coloured, narrow, furnished with a few short bristles in front of median eyes.

Pars Thoracica: Broad, radial grooves distinct, indented on rear margin.

Thoracic Fovea: Small, deep, and straight.

Marginal Band: Narrow and lightly fringed with black bristles.

Eyes: In two rows. When viewed from above the front row is straight and the rear row recurved. The round front median eyes are separated from each other by a space equal to about two-thirds of their individual diameter and from their lateral neighbours by the same distance. The front and rear laterals are equal in size and have a long diameter about one and a third times the diameter of a front median eye. They are poised obliquely and separated by a distance equal to one-third of their long diameter. The rear median eyes are slightly larger in long diameter than the front median eyes; they are separated from each other by a space equal to four times that which separates the front median eyes and from the rear laterals by a space equal to slightly less than half that between the front median eyes. (See Fig. 16.)

Fig. 16. *Hexathele montanus* (*sp. nov.*). Eyes in female.

Legs: Relative lengths, 4, 1, 2, 3. Black, moderately long and tapering. The tarsi are all without a scopula. All the segments of the legs are bespined, except the coxæ, trochanters, and the under side of the femurs. The superior tarsal claws are armed with a diagonal row of about eleven pectinations. The inferior claw has two pectinations. The legs are clothed with black hairs and bristles.

Palpi: Concolorous with the legs and similarly armed and clothed. The single tarsal claw has about nine pectinations.

Falces: Black, large, and strong; clothed with bristles but without a rastellum. Fang well curved and long. Inner margin of falx sheath has a row of eleven teeth. The outer margin is thickly fringed with hair.

Maxillæ: Dark brown with a thick fringe of reddish brown hairs along the inner margin. The inner fore corner is produced into a well marked prominence, but not to the same extent as in the male. Inner surface concave. Heel is rounded and furnished with a group of spines.

Labium: Slightly longer than broad, truncated in front, clothed with bristles and short spines, separated from the sternum by a well marked groove.

Sternum: Black, ovate, clothed with black bristles and hairs, excavated in front round the labium.

Sigilla: Moderately large, about equal in size and situated near the margin.

Abdomen: Obovate, black, clothed with long black bristles and faintly marked with five pairs of yellowish spots as in the male. Anterior portion overhangs the base of the cephalothorax. Lung covers yellow.

Spinnerets: Six in number. The superior pair 5.6 mm. long, tapering; the third joint is the longest, being slightly more than twice the length of the second joint, and one and a half times the length of the first joint, which is divided at the rear as in the male. The second pair of spinnerets are short, cylindrical, and equal in length to the second joint of the superior pair. They are separated by about four times their individual diameter. The third pair are slightly longer than the second pair, cylindrical, and end in a concave tip in which there is a sunken dome. They are situated outside the second pair, but close to them, and a little more to the front. Anal tubercle prominent. (See Plate IX., Fig. 11.)

Locality: Higgs' Track, Western Tiers, Chudleigh. 2nd April, 1926.

Observations: The genus *Hexathele* has not been recorded from Australia previously. It is a typical New Zealand genus (7).

Field Notes: Both the male and the female were found in burrows in a moss-covered, rotten log. One or two immature specimens were taken under stones. The burrows in the log seemed to have been made in cracks and crevices, which already existed. These the spider had lined with a thin layer of white silk. The opening to the burrow was not provided with a lid. The specimens were taken at an altitude of about 2,500 feet.

Family THERIDIIDÆ.

Genus *Ariamnes*, Thor.

Ariamnes patersoniensis, sp. nov.

Plate X.

The description of a single female specimen is as follows:—

Measurements in millimetres.

Total Length	16.7
Length of Cephalothorax	2.2
Breadth of Cephalothorax	1.0
Length of Abdomen	14.5
Breadth of Abdomen	0.9

Leg	Coxa	Trochanter	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
1	0.4	0.4	5.9	0.6	2.1	5.2	1.4	16.0
2	0.4	0.2	3.2	0.5	2.0	2.1	1.1	9.4
3	0.2	0.2	1.8	0.4	0.9	1.0	0.8	5.3
4	0.3	0.3	5.3	0.6	3.6	4.3	1.7	16.1

Cephalothorax: Yellowish brown, arched, more than twice as long as broad, very narrow in front, broadest above the coxæ of legs II., and does not become appreciably narrower towards the rear, clothed with a few short isolated hairs.

Pars Cephalica: Raised, narrow, and only two-fifths of the total length of the cephalothorax. The segmental groove is distinct.

Ocular Area: Broader than long; the four median eyes occupy the corners of a raised area which is almost square in outline.

Clypeus: Yellow, deep, the distance from the front median eyes to the edge of the clypeus is equal to twice the space which separates the front median eyes. A few scattered hairs are visible.

Pars Thoracica: Arched, radial grooves distinct, but not deep, rear margin slightly indented.

Thoracic Fovea: Very indistinct.

Marginal Band: Narrow, yellow, not fringed with hairs.

Eyes: Front row strongly recurved and longer than the rear row, which is strongly procurved. The eyes of the front row are slightly larger than the corresponding eyes of the rear row. All the eyes except the front laterals are mounted on black rings. The space between the front medians is

equal to once their individual diameter, and is slightly greater than the space between the rear medians. The front and rear laterals of the same side just touch each other. The space which separates the rear medians from the rear laterals is equal to about half the diameter of a front median eye, and the same distance separates the front medians from the front laterals.

Legs: Relative lengths, 4, 1, 2, 3; slender, lightly clothed with stiff, straight bristles. The legs are yellow in colour except the tips of all the tarsi and the femur, patella, and tibia of leg. I., which are brown, and metatarsus I., which is very pale yellow, almost white. The comb on tarsus IV. consists of a row of twenty setæ, the eight nearest the claws have two teeth each, the eight nearest the metatarsus are bare, while the middle four have a single tooth each.

Palpi: Short, yellow, clothed with short bristle-like hairs, which are more numerous on the tarsus than on the other segments. The single claw is long, fine, and provided with two pectinations.

Falces: Vertical, strong, reddish yellow, clothed with a few short dark brown bristles.

Maxillæ: Yellow, long, narrow, furnished with a well-developed serrula and clothed with a few scattered hairs.

Labium: Yellowish, semi-circular, appears to be continuous with the sternum being separated therefrom by a shallow indistinct groove.

Sternum: Yellow, covered with brown tubercles, each of which is provided with a hair. It is twice as long as broad, its greatest breadth being between the coxæ of legs II.; ends in a point between the fourth coxæ.

Abdomen: Long and vermiform, being nearly seven times the length of the cephalothorax. The upper surface is dark fawn mottled with brown, whilst the under surface is fawn. The whole surface is thinly covered with short yellow hairs and with brown tubercles like those on the sternum. The anterior margin of the upper surface is fringed with long dark brown hairs which project forward over the base of the cephalothorax. The abdomen terminates in a blunt rounded extremity.

Epigynum: Takes the form of a rounded elevation about 0.5 mm. from the base of the abdomen.

Spinnerets: Situated 2.3 mm. from the base of abdomen.

Fig. 9. *Hexathele montanus* (*sp. nov.*) ♂.

Fig. 10. *Hexathele montanus* (*sp. nov.*) ♀.

NATIONAL MUSEUM MELBOURNE

Fig. 11. *Hexathele montanus* (*sp. nov.*) ♀
showing the six spinnerets.

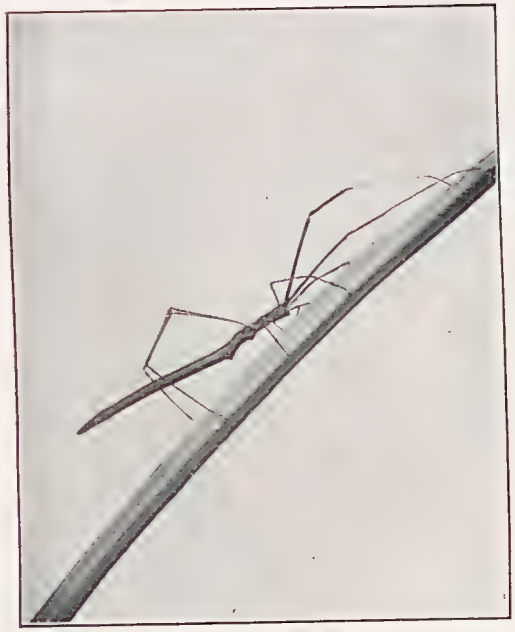

Fig. 12. *Ariamnes patersoniensis* (*sp. nov.*) ♀.

Fig. 13. *Ariamnes patersoniensis* (*sp. nov.*) ♀.
Egg sac.

Observations: The species described above, although closely allied with *Ariamnes colubrinus* (Keys.) (8), differs from it in the following points:—

(1) The rear row of eyes is strongly procurved instead of "ein wenig procurva."

(2) The thoracic fovea is indistinct instead of "sehr tief."

(3) The end of the abdomen is rounded instead of "spitz."

Locality: Patersonia, near the Launceston Water Purification Plant., 29th January, 1926.

Field Notes: The web of this spider consists of an irregular net work of threads, and is similar to the usual *Theridion* type of snare. It is hung about five feet from the ground in fairly thick scrub, near the bank of a creek. The egg sac is made of white silk mottled with brown patches. It is shaped like a miniature Chinese lantern (see Plate X., Fig. 13), and suspended by a thick thread in the centre of the web. The spider rests upside down in a horizontal position near the egg sac. In this position the fourth pair of legs are directed to the rear and pressed close to the body; the other legs are directed forward and close together. While resting in this manner the spider resembles a bit of dry stick such as might have fallen into the web. When moving, however, it carries the long vermiform abdomen bent in an S-shaped curve over the cephalothorax.

Family CLUBIONIDÆ.

Sub-Family MICARIINÆ.

Genus *Myandra*, Simon.

Myandra bicincta, Simon.

This spider was first recorded from Boyanup, Western Australia, and described by Simon (9). His description, however, is based on an immature female. The following notes deal with adult specimens of both the male and the female, which were found at Launceston.

The description of the male is as follows:—

Measurements in millimetres.

Total Length	2.5
Length of Cephalothorax	1.1
Breadth of Cephalothorax	0.9
Length of Abdomen	1.4
Breadth of Abdomen	0.8

Leg	Coxa	Trochanter and Femur	Patella and Tibia	Metatarsus and Tarsus	Total
1	0.24	0.90	0.97	1.18	3.29
2	0.22	0.83	0.85	1.15	3.05
3	0.22	0.77	0.82	1.12	2.93
4	0.29	1.12	1.18	1.55	4.14
				Tarsus	
Palpi	0.17	0.42	0.28	0.42	1.29

The male closely resembles the female, differing only in size and in the following features:—

Legs: Each of the two tarsal claws has a single blunt pectination and the tip of the claw is finely serrated.

Palpi: Short, clothed with plumose hairs, no spines present. The tibial segment is produced into an apophysis which ends in a bifid point. The genital bulb is large. The style is long, and in the unexpanded bulb it curves back towards the base of the alveolus and then forward towards the apex, where its tip is bent under a hook-like conductor. (See Fig. 17.)

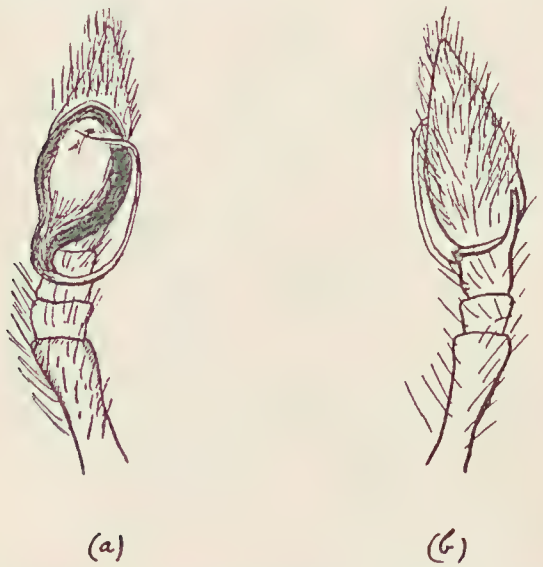

Fig. 17. *Myandra bicincta* (Simon). Palpus of male—(a) from below, (b) from above.

In other respects the male resembles the female (see below).

The description of the female is as follows:—

Measurements in millimetres.

Total Length	2.8
Length of Cephalothorax	1.1
Breadth of Cephalothorax	0.9
Length of Abdomen	1.7
Breadth of Abdomen	1.0

Leg	Coxa	Trochanter and Femur	Patella and Tibia	Metatarsus and Tarsus	Total
1	0.33	1.23	1.31	1.36	4.23
2	0.31	1.13	1.18	1.60	4.22
3	0.28	1.04	1.04	1.47	3.83
4	0.45	1.60	1.60	2.08	5.73
				Tarsus	
Palpi	0.18	0.55	0.48	0.44	1.65

Cephalothorax: Ovate, narrow and rounded in front, shining, black; clothed with long and with short, silvery-white, plumose hairs.

Pars Cephalica: Narrow, arched, sloping gently forward; cervical groove not well marked.

Ocular Area: Slightly arched, broader than long.

Clypeus: Very steep, not as broad as the ocular area.

Pars Thoracica: Slopes steeply down towards the rear, indented at its rear margin, radial grooves not distinct.

Thoracic Fovea: Not present.

Marginal Band: Narrow, slightly reflexed, no fringe present.

Eyes: Anterior row procurved, posterior row strongly procurved. The eyes of the front row are equal in size, spaced evenly and moderately close. Rear median eyes oblong, with their long diameter transverse; they are slightly farther away from each other than from their lateral neighbours. The four median eyes occupy an area about equal in length and breadth, but narrower in front than in rear. Lateral eyes of the same side almost touching each other, the front slightly larger than the rear eye. (See Fig. 18.)

Legs: Relative lengths, 4, 1, 2, 3; legs I. and II. being almost equal in length. All the legs are clothed with plumose hairs. No scopula is present, but the ends of the tarsi are provided with bundles of tenent hairs. Coxæ are light brown in colour; femurs very dark brown; tibiæ I. and II. dark

brown above, light brown underneath; tibiæ III. and IV. nearly black. The two tarsal claws have no pectination. No spines present on the legs.

Fig. 18. *Myandra bicincta* (Simon). Eyes in female.

Palpi: Concolorous with the legs and of similar clothing. One or two spines are present on the tibial and tarsal segments.

Falces: Dark brown; fang is short, curved, and finely serrated. There are two teeth on the inner margin of falx sheath, three on the outer margin. Standing out from among the hairs near the base of the fang is a long conspicuous plumose hair. (See Fig. 19.)

Fig. 19. *Myandra bicincta* (Simon) ♀. Falx.

Maxillæ: Dark brown, broad, inner margin fringed with a thick beard, a well-developed serrula at the apex.

Labium: Small, conical, truncated in front, and provided with long hairs at the apex; separated from the sternum by a well-marked groove.

Sternum: Broadly ovate, shining black, arched, produced into a sharp point between the fourth coxæ.

Abdomen: Long, narrow, rounded in front and in rear, black, decorated above with two transverse bands of white plumose hairs and a white spot near the apex. Under surface clothed with white plumose hairs.

Epigynum: A somewhat raised triangular opening, dark brown in colour. (See Fig. 20.)

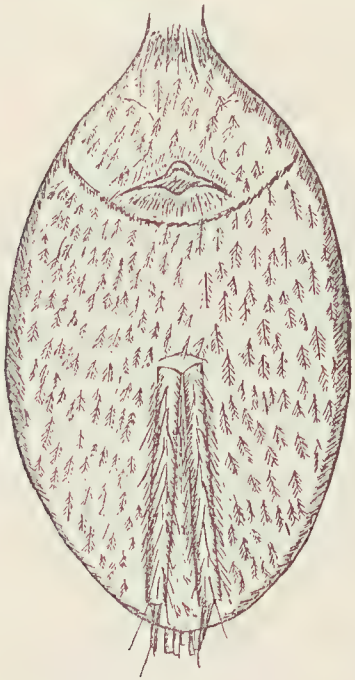

Fig. 20. *Myandra bicincta* (Simon). Abdomen of female from below.

Spinnerets: Inferior pair stout and long rising from the middle of the ventral surface of the abdomen and reaching to its apex. They are yellowish near the base, becoming gradually dark brown towards the tip. The other spinnerets are small and situated at the apex of the abdomen. (See Fig. 20.)

Locality: Lawrence Vale, Launceston. January, 1926.

Field Notes: *Myandra bicincta* is often found in company with the small black ants (*Camponotus nigriceps*, Smith), and to these it bears a superficial resemblance, when running quickly here and there in the sunshine on a garden path.

Types: The type specimens of spiders described in the above paper and also of those described in my previous paper (10) will be placed in the Queen Victoria Museum, Launceston.

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STUDIES IN TASMANIAN CETACEA.

Part V.

Mesoplodon layardi, Gray.

By

H. H. Scott, Curator of Queen Victoria Museum, Launceston,

and

Clive Lord, F.L.S., Director of the Tasmanian Museum, Hobart.

(Read 11th October, 1926.)

HISTORY.

The specimen under review was secured in Recherche Bay, D'Entrecasteaux Channel, during the winter of 1925, by Mr. H. Smith, and later the skeleton was obtained and has been articulated for the Tasmanian Museum collection. (Tasmanian Museum Coll. No. D.754.)

THE GENUS AND SPECIES.

As E. R. Waite has published in the Records of the South Australian Museum (1) a detailed description of a young male *Mesoplodon layardi*, and as the present specimen appears to be fully adult, it will be a useful comparison to construct our tables in terms of his; but, before doing so, attention is directed to the following notes upon the skull.

SKULL.

The skull, which is not quite intact, is 830 mm. long and 300 mm. wide at the *squamosal* regions. Its height from the par-occipitals to the vertex is 370 mm. The narial basin is 125 mm. wide and 112 mm. long, the limit in this direction being the actual bony depression which terminates at a line drawn across the two foramina. Narial asymmetry is not strongly marked, but standing behind the skull it can be noted that the right nasal aperture is slightly larger than the left. The mesorostral is completely ossified, the palatines, vomer, maxilla, and inter-maxilla having

all united to form a solid bony beak. For 25 mm. in front of the narial basin there is a pit containing (2) perfectly hard, fenestrated bone, apparently the last remains of ethmoidal cells. In front of this the ossified mesorostral takes origin, and for the first 50 mm. of its length develops in the form of a groove 18 mm. wide, and manifests the minor asymmetry of the individual skull. For the next 75 mm. the bone contracts to about 8 mm. Thence, for the next 80 mm., it gradually expands to a maximum of 12 mm. — and lastly, for the next 230 mm., although retaining its width, it merges into the surrounding bones in an elongated area of depression. The present skull at its apex, namely, the common meeting place of the supra-occipital, the maxilla, inter-maxilla, nasals, and frontals, the whole of the bone is shattered by shot, dozens of which are still embedded in the bone.

Measurements of the girth of the beak, at points indicated above, give the following data:—

Girth at junction of area two and three	260 mm.
Girth at junction of area three and four	187 mm.
Girth at junction of area four and five	176 mm.
Girth at junction of area five and six	117 mm.

At the base of the skull the pterygoids are mutilated and except for a small moiety upon the right side the malars are missing—the fragment shows that at 40 mm. from its gomphosial origin it was only 2½ mm. in diameter. The mandibular symphysis is 280 mm. long, and a width between the posterior summit of the two teeth of 70 mm., the least anterior width being 35 mm. The teeth are 90 mm. long, and rise 35 mm. above the alveolar ridge. They are situated 210 mm. from the tip of the united rami. The coronoid is too mutilated to supply much evidence—apparently its depth was about 120 mm.

COMPARATIVE MEASUREMENTS.

Item.	Specimen described by Waite.	Tasmanian Whale.
Extreme length of Cranium	853 mm.	830 mm., incomplete.
Length of rostrum tip to antorbital notches	574 mm.	560 mm., ditto.
Tip of rostrum to end of palate	678 mm.	600 mm., mutilated at both ends.

Item	Specimen described by Waite.	Tasmanian Whale.
Height vertex to pterygoids	338 mm.	370 mm.
Breadth across orbits ..	328 mm.	300 mm., right side is mutilated.
Breadth at squamosals ..	256 mm.	315 mm.
Breadth at antorbital notches	197 mm.	200 mm.
Breadth in middle of rostrum	68 mm.	49 mm.
Breadth across condyles ..	115 mm.	110 mm.
Premaxilla greatest width behind anterior nares	156 mm.	no data (shot away).
Least width opposite anterior nares	110 mm.	118 mm.
Greatest width in front of anterior nares	111 mm.	122 mm.
Width of anterior nares ..	50 mm.	53 mm.
Length of tympanic	44 mm.	52 mm.
Width of tympanic	30 mm.	30 mm.
Length of ramus	742 mm.	no data, mutilated.
Length of symphysis	166 mm.	280 mm.
Height of ramus	113 mm.	120 mm.

Although fully adult, the rostral groves are strongly in evidence, and apparently would be so throughout life.

VERTEBRÆ.

The species is usually accredited with 48 vertebræ, 46 are present and the last two or more caudals are missing. The cervicals show the last three quite free, and upon maceration a fourth may become detached, but the remainder are firmly ankylosed into a solid block. The vertebral formula was apparently:—C.7, D.10, L.11, Ca.20. Total, 48.

The largest lumbar gave the following data:—

Centrum, 95 mm. wide x 85 mm. high.

Length of body, 118 mm.

Across diapophyses, 260 mm.

Greatest height, 386 mm.

Width of spine, 130 mm.

The rest of the skeleton conforms to published accounts, and is available for detailed study if needed.

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TWO HYDROMEDUSOID RECORDS FOR TASMANIA.

By

PROFESSOR T. THOMSON FLYNN.

(Communicated by L. Rodway.)

(Read 11th October, 1926.)

Some plankton originally obtained from D'Entrecasteaux Channel, Tasmania (October, 1921), has been subjected recently to examination, one of the results being the discovery of two species of the Genus *Eutima* (*Leptomedusæ, Eucopidæ*) which can now be recorded for Tasmania.

One of these proves to be *Eutima pretiosa,* Haeckel, described in the *System der Medusen* in 1879. I have not seen the original description, but a summary of the specific characters is given by Mayer in *The Medusæ of the World,* Vol. II.

The locality given by Haeckel is "off the coast of "Australia." Apparently it has not been recorded since 1879.

The second specimen is even more interesting in that it appears to be specifically identical with *Eutima elephas,* Haeckel, found originally at Heligoland in 1854 (*System der Medusen,* 1879).

Mayer says that an apparently identical medusa appears each year at Tortugas, Florida, in July.

Our Tasmanian species appears to agree in every structural feature with the species described by Mayer.

While it may be questioned whether it is possible for one species to have such an extensive geographical range, the apparent identity of structural features compels the inclusion of this Tasmanian form in the species *elephas.*

In neither case was the colour of the medusa recorded. Mayer states that the hydroid stage of these medusæ is *Campanopsis.* Mr. E. A. Briggs, of the University of Sydney, a well-known authority on the Australian Hydrozoa, informs me (*in litt.*) that this latter genus has not been recorded from Australia.

NOTES ON, AND ADDITIONS TO, THE CHITON FAUNA OF NORTH-WEST TASMANIA, TOGETHER WITH A BRIEF REVIEW OF THE GENUS *STENOCHITON*.

By

EDWIN ASHBY, F.L.S., etc.

(Read 20th December, 1926.)

INTRODUCTION.

This paper was commenced over a year ago as a joint paper in collaboration with the late W. L. May, but was laid aside owing to the untimely death of Mr. May, whereby the writer has lost his greatest friend, who was his colleague on so many collecting trips, and Science has lost a conchologist of outstanding ability.

The earlier part of the paper records the results of a collecting trip to the north-western corner of the State. The party consisted of W. L. May, Watson Coleman, Miss Ashby, and the writer.

The 28th and 29th October, 1924, were spent at Robbins Island and the 30th and 31st at Penguin. Robbins Island from a collector's point of view was virgin ground. The main work was done in the two afternoon tides, and the reefs worked were those several miles to the west of the Homestead at Gyton Point. The rocks were diabase or allied igneous rock, the first day's work being confined to the most easterly of the series of reefs that form the western wing of the Homestead Bay, and on the second day, May worked some rock pools on the eastern side of the main reef while Coleman and the writer worked some very likely, somewhat sheltered ground on the western side, immediately below the Bluff upon which the Manager's House is situated. Each of these reefs was found numerically rich in examples but limited in species; so much so that we decided to shorten our stay, in order that some work might also be done at Penguin, before the passing of the low tides.

The work done on the main reef was through an unfortunate circumstance incomplete; as that was the only spot where a representative of the subgenus *Rhyssoplax* was taken, it is certainly worthy of a more thorough investigation. Ashby was the only one of the party that was able

to get out on the reef at Cape Elio near the Homestead, at one of the early morning tides. While the work on that ground yielded no additional species, it was remarkable for the great number of *Ischnochiton lineolatus*, Bl., that were found there, whereas at the three places worked at the western wing of the bay, less than 3 miles away, very few examples of this species were met with. At the latter places, *I. subviridis* was in hundreds, but at the eastern reef the numerical strength of the two species was about equal. The rocks and conditions at each wing of the bay were equally promising, and the reasons for the astonishing discrepancy are not patent. This instance should be a warning to all workers not to assume too readily that a species is necessarily absent from a locality, because one has not found it at the few reefs one has been able to work. The discovery of representatives of the two genera, *Stenochiton* and *Lepidopleurus*, new to the State is of particular interest.

Class AMPHINEURA

Order *POLYPLACOPHORA*, Blainville.

Suborder EOPLACOPHORA, Pilsbry, 1900.

Family LEPIDOPLEURIDÆ, Pilsbry, 1892.

Genus *Lepidopleurus*, Risso, 1826.

Lepidopleurus matthewsianus, Bednall, 1906.

=*L. niger*, of Torr, and *Terenochiton erratus*, of Hull.

A nice series was taken at Robbins Island mostly on the reef immediately below the Mutton Bird Rookery and the Manager's House; most of the examples are pale biscuit colour with bright red bodies, a feature which is characteristic of the species. Only one example has previously been recorded from Tasmania, and that was taken at Devonport. The type locality is Marino, in South Australia, the specimens from which the description was made were given to Bednall by the writer, and came from that locality. The same species was found by Torr at Hopetoun, in Western Australia, and described by him under the name *L. niger*, and later on was found at King George Sound, in the same State, by Hull, and described by him under the name *Terenochiton erratus;* both these names are synonyms of the species under review.

Lepidopleurus badius, Hedley and Hull, 1909.

While much less numerous than the preceding species, a nice series was taken at Robbins Island living in the same sit-

uation as *matthewsianus;* most of them are rufous or orange rufous in coloration, the largest measuring 4.5 mm. in length. The sculpture differs from that of *matthewsianus*, in the wider spacing of the longitudinal rows and the wider spacing of the granules in the rows, in some examples these rows are ill-defined. This is the first record of this shell occurring in Tasmanian waters, and forms an interesting addition to its fauna. The writer has taken it at several localities in Gulf St. Vincent, in South Australia, and in 1923 at Port Stephens, in New South Wales, these places forming the extreme limits of its known range westward and northward The present record from Robbins Island extends its range considerably in a southerly direction. The species seems everywhere to be very local, but this may be due to its minute size making it easily overlooked.

Lepidopleurus profundus.

Lepidopleurus profundus (Ashby MS.) May. Illus. Index, Tas. Shells, 1923.

L. profundus of Ashby, Trans. Roy. Soc. S. Aust., vol. xlvii, read May, 1923.

Parachiton collusor of Iredale and Hull. Aust. Zool., vol. iii., pt. viii., 1925, p. 346.

Parachiton profundus of Iredale and Hull, l.c.

Introduction.—The late W. L. May quite unintentionally published Ashby's name *profundus* a few months prior to the publication of his type description, publishing only a figure without definition. Good as the figures are, without reference to Ashby's definitions, the fig. cannot be separated from *L. liratus*, Ad. and Ang., thus to make the reference complete it will have to be written *Lepidopleurus profundus* (Ashby MS.) May, 1923. Both May and the writer considered that the splitting of the genus *Lepidopleurus* into various genera as proposed or adopted by Iredale and Hull, has not up to the present been justified by adequate generic definitions. In illustration, Iredale and Hull, in their remarks on *L. profundus*, Ashby, state "This shell looks like "a deep water form of *Terenochiton liratus*, in which the "girdle scales have been replaced by spicules," and yet they place it in a different genus.

As before stated, it was originally intended to publish this paper as a joint one in collaboration with W. L. May, and on 30th June, 1925, he forwarded to the writer the shells from which he had made his drawings, in order that by

careful re-examination it might be ascertained whether there was any justification for the action of Iredale and Hull in making two species out of the examples described by Ashby under the name *L. profundus*, the following notes are the results of this re-examination.

Notes.—Iredale and Hull claim that the South Australian shell (type of *profundus* of Ashby) "compared with May's "*L. profundus*, the sculpture of the central areas is finer; "the mucro more posterior."

I have now carefully recompared Tasmanian examples from Pilot Station, D'Entrecasteaux Channel, Port Arthur, and Geographe Strait, with the type of *profundus* of Ashby. I find the character of the sculpture is identical, the longitudinal grooving in the median areas is a little broader in the type from South Australia than in most of the Tasmanian examples, and there is a tendency in those from Tasmania for the ribs to be a little broader, and in some the granulation is a little coarser, but there is as much variation in this respect between the different Tasmanian examples, in some cases between the different valves or portions of the same valve, in the same shell, as between the South Australian specimen and a paired example from D'Entrecasteaux Channel.

The type from South Australia, although not disarticulated, shows the whole of the dorsal portion of the tail valve, thus making it possible to take measurements, and this was possible only in the case of one very juvenile shell amongst the Tasmanian series.

As no disarticulated specimen was available to settle the question raised about the mucro, I disarticulated one medium-sized example from the Pilot Station and found that the mucro is central, as is also that of the South Australian shell. Measurements were made under a microscope with the aid of a micrometer, but, finding the adjustment was loose, one had to discard these and content oneself with the use of callipers, which gave the following:—South Australian shell, 2 mm. between the anterior margin of tail valve and mucro, and between the posterior margin and mucro also 2 mm.. in the Tasmanian example the same measurements are respectively 1½ mm. and 1½ mm.

Conclusions.—

(a) Iredale and Hull's contention that the South Australian shell can be specifically separated from the Tasmanian on the grounds of the sculpture of the median valves is demonstrated to be incorrect.

(b) The contention that the mucro in the former "is "more posterior" than the latter, is unsupported, and can only exist in an unimportant degree in selected examples.

(c) The writer unhesitatingly endorses the opinion which the late W. L. May and himself jointly came to, and which has already been emphatically expressed in his paper l.c., viz., that the dredged shells from South Australia and Victoria described by himself under the name *L. profundus* are conspecific with the Tasmanian shells figured by May under the same name; Iredale and Hull's name *Parachiton collusor* is a synonym of *Lepidopleurus profundus* (Ashby MS.) May.

(d) As it is believed that the publication of the name *profundus* by May, unintentionally preceded the publication by Ashby by a month or two, the two specimens figured by May, which were paratypes of Ashby's *profundus*, now become co-types of *profundus;* May's complete figure represents a shell dredged at Port Arthur, and the enlarged portion of a median valve is from a specimen dredged in nine fathoms off Pilot Station, D'Entrecasteaux Channel. The statement made by Iredale and Hull, l.c., p. 347, "That the foregoing description is the "first published of May's species" is of course incorrect. Neither are they correct in stating that the shell figured by May was one of the original series, nor did it come from the Pilot Station, River Derwent.

Lepidopleurus profundus and *liratus* Compared.

In *liratus* the sculpture of the pleural areas consists of longitudinal rows of circular, convex, separated granules, which are bridged across from one row to another by irregular, ill-defined ridges. In *profundus* this sculpture consists of longitudinal, granulose ribs, the granulations in the ribs being flat-topped, and each granulose rib is bridged across to the next one by numerous, regular, well-defined narrow ridges.

The sculpture of *liratus* may be likened to a string of circular beads almost touching one another and roughly and widely bridged across from one row to another, whereas the sculpture of *profundus* is quite distinct, and may be likened to a longitudinal string of beads that have been squeezed together when soft and planed or flattened along the top and narrowly bridged across to the next rib at each granulation.

Suborder CHITONINA, Thiele, 1910.

Pilsbry places the *Ischnochitonidæ* and the *Mopaliidæ* earlier than the *Acanthochitonidæ*, in the order named, but Thiele considered this latter Family more primitive than the *Ischnochitonidæ*. Owing to the additional light thrown upon this group by the examination of examples of the fossil genus *Protochiton*, I place the Family *Protochitonidæ* immediately above the *Lepidopleuridæ*, considering that these forms were the progenitors of the *Acanthochitonidæ*, expressing it as my opinion that this latter family was never derived from the *Lepidopleuridæ*, but from an even more primitive stock, along parallel lines, and await the confirmation of this surmise by the discovery of intermediate fossil forms. Should this data be forthcoming a suborder *Protochitonina* will have to be introduced and the Phylum *Acanthochitonidæ*, built up thereon. As now treated I cannot but think that the suborders *Eoplacophora*, Pilsbry, *Lepidopleurina*, Thiele, and *Chitonina*, Thiele, are taxonomically incorrect.

Family ACANTHOCHITONIDÆ, Hedley, 1916.

Subfamily ACANTHOCHITONINÆ, Ashby, 1925.

Genus *Acanthochiton*, Gray em. 1821.

Acanthochiton sueuri, Blainville, 1825.

Numerous at Robbins Island and less so at Penguin.

Acanthochiton bednalli, Pilsbry, 1894.

Found both at Robbins Island and Penguin, but in greater numbers at the former, it is easily distinguished by the deep longitudinal grooving in the dorsal areas; a few large examples were found at Port Sorell, one measuring 18 x 9 mm.

Acanthochiton granostriatus, Pilsbry, 1894.

Two examples were taken at Penguin, the dorsal area is narrower than in *bednalli*, is smooth except for growth lines, and is polished.

Acanthochiton variabilis, Ad. and Ang., 1864.

Not uncommon at Penguin, where some rather striking colour varieties were met with, it was not noted at Robbins Island, but several large specimens were secured at Port Sorell, one measuring 13 x 7 mm.

Genus *Notoplax*, H. Adams, 1861.

Notoplax glyptus, Sykes, 1896.

I am glad to be able to record this rare species as from Tasmania. A couple of specimens were in a collection made by the late Mrs. Alfred Smith, at one time resident at Swansea, on the East Coast; her daughter, Miss K. C. Smith, writes me that all the specimens in this collection were certainly Tasmanian, and adds "Chitons were especially peculiar "to the Swansea Beaches, and always after a storm we used "to find them in great numbers," and again, "My mother "collected some of her best specimens from the Stanley "Beaches, N.W. Coast." While there is not the slightest doubt that these examples were collected in Tasmania, the choice of locality is between Stanley and Swansea, the weight of probability is in favour of Stanley. The known examples of this shell are very limited, all have hitherto been credited to Victoria from Port Phillip Heads, Portsea, Western Port, and two examples taken from off the cable in Bass Strait by the late Mr. Joseph Gabriel in 1910. Mr. May first noticed a strange Chiton in this collection, which was still in its original glass case, and took the writer round to determine whether it was an undescribed species or not. The two specimens were presented us by the present owner, Miss P. Bailey, of Hobart—one is in Mr. May's collection, the other in my own. The following are particulars of this latter specimen: The shell is curled, girdle wasted, and semi-transparent, with a few exceptions the spicules have disappeared from the sutural pores, but in a few cases the bases of the spicules are retained. The valves are in excellent preservation with the exception of a fracture of one median valve; the shell is highly polished, the ground colour greyish green, flecked and mottled with ivory white; the pleural areas show four broad but shallow longitudinal grooves, the rest of shell is smooth and highly polished. In one of the small specimens taken off the cable, now in my collection, the ground colour is creamy white with a slight greenish shade in the mottling, the sutural hairtufts are furnished with slender spicules, and short spicules are scattered about the girdle. The specimens in the Smith collection have evidently been washed up, the body being absent, I indicate Stanley as the probable locality.

Subfamily CRYPTOPLACINÆ, Thiele, 1910.

Genus *Cryptoplax*, Blainville, 1818.

Cryptoplax striatus, Lamarck, 1819.

This was a common species at Robbins Island, examples measuring up to 80 mm. in length dry. In "A Review of "the genus *Cryptoplax*" (Trans. Roy Soc. S. Aust., vol. xlvii., 1923), the writer pointed out that specimens from King Island had shorter and broader spicules than examples from South Australia, the type locality, and he considered from his examination of Reeve's type of *gunni* in the British Museum, that the King Island shell might well be referred to that variety. As both forms exist side by side in the southern part of Tasmania the character mentioned hardly deserves distinguishing with a name as a variety. Iredale and Hull (Aust. Zool., vol. iv., pt. ii., 1925), under *C. iredalei*, Ashby, refer to May's fig. pl. xvi., no. 7, as if it was intended for the form with short slender spicules described by the writer under the name *C. iredalei*. This is an error, May's figure was intended I believe to depict Reeve's *var. gunni*, and this means that Iredale and Hull's name *C. iredalei meridiana*, must be considered a synonym of *gunni* of Reeve. I have not seen their type.

Cryptoplax iredalei, Ashby.

Several examples of this shell were secured at Robbins Island, the largest measuring over 70 mm. in length when dry. This species can easily be separated from the common form *C. striatus*, in that *iredalei* has short and slender spicules, giving a velvety appearance to the girdle. Both May and the writer considered that hitherto the only example recorded from Tasmania was a single example taken by May on his return from King Island in November, 1922, I think at Devonport. The occurrence is recorded by the writer, l.c., p. 238. Thus Robbins Island forms an interesting extension of its Tasmanian range.

Family CALLOCHITONIDÆ, Thiele, 1910.

Subfamily CALLOCHITONINÆ, Thiele, 1910.

Genus *Callochiton*, Gray, 1847.

Thiele proposed a subgenus *Icoplax* with *C. puniceus*, Couthony, as type, a New Zealand species. Iredale and Hull l.c. propose to elevate *Icoplax* to full generic rank, but the characters referred to in their definitions can only be

considered as of specific or at most subgeneric value, and until adequate generic characters are defined I prefer to leave *C. mayi* under the genus *Callochiton*.

Callochiton mayi, Torr, 1912.

A nice specimen, 10 mm. in length, of this striking and rare *Callochiton* was taken at Penguin in a rock pool at the lowest point of the tide. It was the second example the writer has taken, the other having been collected in the D'Entrecasteaux Channel, in Southern Tasmania. The only records other than Tasmanian are Portland, Victoria, 1 example, and several dredged by Sir Joseph Verco in South Australian waters.

Genus *Eudoxochiton*, Shuttleworth, 1853.

Subgenus *Eudoxoplax*, Iredale and May, 1916.

Both May and the writer were agreed that Iredale and Hull l.c. have furnished no justification for their proposal to elevate *Eudoxoplax* into generic rank. We considered it was not generically separable from *Eudoxochiton*, and doubted as to whether even subgeneric separation was justified. Decision on this latter point must be left to a careful investigation.

Eudoxochiton (*Eudoxoplax*) *inornatus*, Ten.-Woods, 1881.

One example taken at Penguin.

Family MOPALIIDÆ, Pilsbry, 1892.

Genus *Plaxiphora*, Gray, 1847.

Plaxiphora albida, Blainville, 1825.

A few examples were taken at both Robbins Island and Penguin, all of which are the costate and wrinkled form; limitations of available time prevented the collecting of more material to enable one to determine the extent of variation in the respective localities. Thiele seems to have had very few examples available to him for examination, and to have found the variation so great, that he was led to suggest a different name (almost) for each example. One had hoped that Iredale and Hull would have given the time to enable them to make an exhaustive examination of a large series, but this has not been done. They reproduce Thiele's figures of *costata*, *albida*, *tasmanica*, and *bednalli*, and allow only the two former. I have already pointed out (Trans. Roy. Soc. S. Aust., vol. xlvi., 1922, p. 575) that both Blainville's types were conspecific, the fact that this was so having been overlooked by Thiele through the valves of the type of *albida*

having had the original sculpture eroded, but in one median valve sufficient coarse wrinkling is present to determine its character — unfortunately the name *albida* has page precedence. It is absurd for Iredale and Hull to attempt to retain both names. Thiele, in view of the apparent absence of coarse wrinkling in the eroded type of *albida*, concluded that it must be conspecific with the "microscopically wrinkled" or smooth shell, which was described by Quoy and Gaimard under the name *Chiton glaucus*, the type of which was shown to me in Paris.

To make confusion worse confounded Iredale and Hull have reversed the application of Thiele's letterpress. His drawing of *costata* is a poor one, as it does not show the, what we now term, coarse wrinkling, which is very much in evidence in the type which was handled by Thiele and referred to and drawn by him under the name *costata*.

Genus *Kopionella*, Ashby, 1919.

Kopionella matthewsi, Iredale, 1910, *var. intermedia*.

Three examples were taken at Penguin, each having the peculiar "oar-headed spicules" which were discovered by the writer and described by him in 1919, the generic name being founded on this feature coupled with the distinctive shape of the tail valves, as major characters.

The Penguin specimens correspond with the South Australian shell in the coarse granulose character of the two radial ribs of the lateral areas, and in the girdle being furnished with numbers of "oar-headed spicules" placed irregularly around the whole girdle, but the "oar-heads" are not as broad as in *matthewsi*, neither are they bent over as in that species as it is known in South Australia, the type State.

The examples from D'Entrecasteaux Channel, in Southern Tasmania, described by the writer under the name *tasmanica*, possess few of these spicules and their swollen extremities are long, slender, and straight (stiletto shape). It is quite difficult to determine to which species these examples from Penguin are most nearly allied. Until more material is available I suggest recognising them as a variety of the type species under the varietal name *intermedia*, the characters defined as above.

Note.—In 1910 Iredale proposed the name *Plaxiphora matthewsi* for specimens received from South Australia. In 1916 Iredale and May figured a Tasmanian specimen under the same name and genus, either through having overlooked the existence of "oar-headed spicules" or because in the

examples they examined this feature had been removed through careless handling. Iredale and Hull l.c. have now placed this genus immediately following the genus *Loricella*, a possibility that was foreshadowed as possible by the writer in his definition of the genus *Kopionella;* but Iredale and Hull supply no new data in support of this treatment. I prefer to leave the genus under the *Mopaliidæ* until one has time to study the radula in this relationship.

They remark that the "South Tasmanian form has been "differentiated specifically, but no such value is apparent in "the series examined by us," . . . . "the only feature for "separation appears to be in the formation of the corneous processes." These gentlemen have in a number of cases treated differences "in the formation of corneous processes" (i.e., girdle scales) as of the value of generic distinction; it is indeed regrettable that in this case they are not prepared to recognise such characters as of even specific value, and it is unfortunate that they did not avail themselves of the opportunity offered to them to see the types of this and other species.

Family ISCHNOCHITONIDÆ, Pilsbry, 1892.

Subfamily ISCHNOCHITONINÆ, Pilsbry, 1892.

Genus *Ischnochiton*, Gray, 1847.

Ischnochiton lineolatus, Blainville, 1825, *non lineolatus* of Iredale and Hull.

Iredale and Hull propose to recognise in this species *Chiton elongatus* of Blainville, but do not advance the slightest shred of evidence in support of their proposal, neither do they attempt to controvert the apparently incontrovertible evidence advanced by Dupuis, Lamy, and the writer, in support of the recognition in *Ischnochiton crispus*, Reeve, the *Chiton lineolatus*, Blainville, the type of which is still in the Museum de Histoire Naturelle, Paris, and has been carefully examined and compared, by each of the foregoing. The whole question has been fully discussed by the writer (in Trans. Roy. Soc. S. Aust., vol. xlviii., 1924, pp. 329-330). The type locality for this shell is King Island, where it was collected by Péron and Lesueur in 1802; three of the original examples collected by them are now in the writer's collection and written on the inside of the shell of one, in faded ink, but still quite legible are the words "ile King" presumably in the handwriting of one of the famous explorers and naturalists.

As has already been mentioned, this species was scarce on the reefs below the Manager's House, but very numerous at the rocky point near the Homestead. Both sites appeared equally suitable, so the reason for this preference is quite obscure. At Penguin and Port Sorell it was numerous, and at all the localities the species is very variable in colour, pattern, and sculpture. At both Robbins Island and Penguin a variety occurs that has not been noticed elsewhere—it has a grey black central band with light coloured scalloped edging, and is an almost perfect imitation of a dark form of *Ischnochiton subviridis*, which also seems peculiar to those localities.

Ischnochiton atkinsoni, Iredale and May, 1916.

=*I. a. lincolnensis* of Ashby.

=*I. variegatus* of Iredale and Hull, *non* of Angas.

Was fairly common at both Robbins Island and Penguin. It is discussed at some length later in this paper.

Ischnochiton iredalei, Dupuis, 1918.

Subspecies *kingensis*, Ashby and Hull.

I. iredalei, Dupuis=*I. lineolatus* of Iredale and Hull, *non* of Blainville.

Synonymy given fully by Ashby (Trans. Roy. Soc. S. Aust., vol. xlviii., 1924, p. 329).

This species was in great numbers at both Robbins Island and Penguin and noted at Port Sorell. Many specimens measured 40 mm. in length, but what was most remarkable about the whole series was the extraordinary variation in both colour and pattern. In South Australia (type locality by designation) except in juvenile shells, there is but little variation in colour, pattern, and sculpture, whereas in the three dozen N.W. Tasmanian examples mounted on card before me, all but one specimen, which is large, worn, and pale, are easily distinct from any example

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Note.—The writer has recently discussed with Messrs. Gatliff and Gabriel the advisability or otherwise of retaining the name *Chiton pallidus* of Reeve for this shell. On the following grounds we have decided not to accept the name *pallidus*, but to return to the name *I. iredalei*, Dupuis.

The type of Reeve's *Chiton pallidus* is worn smooth, the description is consequently ineffective, the locality is unknown. While I am still of the opinion that Reeve's type is probably a worn example of *I. iredalei*, Dupuis, the accuracy of such an identification can only be determined by disarticulation of the type which may or may not reveal sufficient existing sculpture for determination. I concur with the gentlemen named, in rejecting identifications founded on mere opinions, without the support of adequate data. I therefore retract my identification and agree to consider *Chiton pallens* of Reeve, as a non-Australian shell, until such time as the production of additional data may disprove this course.

seen from the mainland. The colour varies from rose pink, through orange to dark reddish brown, grey brown, and greenish grey, practically all extensively darkly streaked or mottled; the sculpture in all good examples is distinctly sharper and coarser than the South Australian form; it seems well to retain the subspecific name for the King Island and Tasmanian shells to distinguish them as a geographic race. If, later on, material from the northern side of Bass Strait should demonstrate that there is a gradual transition from the typical form to that of the Tasmanian, *kingensis* will then have to be relegated to the rank of a variety only.

Ischnochiton versicolor, Sowerby, 1840, *var. milligani*, Ire. and May.

Ischnochiton proteus, Reeve, 1847, *var. milligani*, Ire. and May.

Two or three examples only were taken at Robbins Island. They are easily distinguished by the large size of the girdle scales. On the mainland typical *versicolor* merge into *milligani*, and it can therefore only be considered a variety.

Since drafting this paper, I have, in conjunction with Mr. J. H. Gatliff, compared Sowerby's figures (Mag. Nat. Hist. IV., 1840, p. 292, figs. 75 and 122) with *I. proteus*, Reeve, and we concur with Iredale and Hull in considering them conspecific.

Ischnochiton virgatus, Reeve, 1848.

A few examples of this charming little shell were taken at Robbins Island. Hitherto the only record of its occurrence within Tasmanian waters is that of King Island and Clark Island. It certainly should be found along the coast between Robbins Island and Penguin. It is remarkable that it has hitherto been overlooked.

Subgenus *Haploplax*, Pilsbry, 1894.

Ischnochiton (*Haploplax*) *smaragdinus*, Angas, 1867.

Common at Robbins Island and Penguin and noted at Port Sorell. At the two former localities the variation in both pattern and coloration was very great. Some of the colour schemes that we have considered as characteristic of Port Jackson re-occur here; two examples from Robbins Island are 30 mm. in length, a size that is only equalled in South-East Tasmania and there very rare.

Subgenus *Heterozona*, Carpenter, 1878.

This section of the genus *Ischnochiton* was treated by Pilsbry as a subgenus; Iredale and Hull grant it full generic rank, but furnish no definitions that can be considered of generic value. The subgenus *Heterozona* is defined by Pilsbry (Man. Con., vol. xiv., p. 65), "Shell like normal "*Ischnochiton;* girdle bearing small scales with large striated "scales intermingled." Type *I. cariosus*. The writer noticed some years ago that *I. fruticosus*, Gould, from Port Jackson, was apparently identical with *cariosus* with the exception that the "large striated, intermingled scales" are not developed as maturity is reached, as is the case with *cariosus*. It was my intention to point out the affinity of these two and to suggest the suppression of the subgenus *Heterozona* on the ground that the accident of the appearance of these large scales in mature examples of *cariosus* can have no other than specific value. Now Iredale and Hull place *fruticosus* (and quite correctly so) next to *cariosus*, a species with which it certainly has the closest affinity, but instead of suppressing the subgenus *Heterozona*, they elevate it to full generic rank and place with it in that genus a species which exhibits none of the defined subgeneric characters, a course that seems absurd. I have, for the purposes of this paper, retained the subgenus *Heterozona* for the two following species, hoping at some future time to revise the subgeneric definition, and if deserving, place it on a more stable basis. I submit that variation in the epidermal clothing of the girdle cannot, unless supported by more important features, be considered as having the value of generic distinction. *Note.*—The writer (in Proc. Roy. Soc. Vict. 33 (N.S.), 1921, p. 151), in error, omitted the generic name *Ischnochiton* before the subgeneric name *Heterozona*.

Ischnochiton (*Heterozona*) *cariosus*, Pilsbry, 1873.

Several examples ranging up to 36 mm. in length, were taken at Robbins Island and one at Penguin. This species, although very common in South Australia, seems to be rare in Tasmania, and has only been recorded from the North Coast. Westward it extends around Cape Leeuwin and up the west coast as far as Dongarra.

Ischnochiton (*Heterozona*) *subviridis*, Iredale and May, 1916.

This species was astonishingly abundant at Robbins Island, especially the reefs to the west of the Bay. There I should estimate that they formed 90 per cent. of the Chiton

fauna. While varieties of various green shades and patterns exist, the great majority are black or blackish grey. In some cases all marking is absent, but in most there is evidence of lateral whitish banding, forming a longitudinal stripe bordering the black dorsal stripe. These black forms seem peculiar to this north coast and occur on black diabase rock.

Genus *Ischnoradsia*, Shuttleworth, 1853.

I here reproduce in full a note by the late W. L. May, of Sandford, Tasmania, which formed an addendum to the writer's Review of the Australian members of this genus (Trans. Roy. Soc. S. Aust., vol. xlii., 1918, pp. 62-64), "Having been "more or less associated with my friend, Edwin Ashby, in "his investigation into *Ischnoradsia*, I am thoroughly in ac- "cord with his treatment in the present communication. From "a superficial glance at specimens from the various localities, "they appear as one species, in shape, size, and colour, and "this impression is confirmed by an examination of the "girdle, which is practically the same in all.

"To maintain the several separate species, viz., *aus- "tralis, evanida,* and *novæ-hollandiæ*, we have to rely solely "on the absence or presence, in varying degrees, of the "longitudinal sculpture; and as this can be shown to be "quite inconstant in the southern and western shells, and "as some of these approximate rather nearly to the Port "Jackson form, it seems necessary to treat them all as mem- "bers of one variable species, but for convenience to main- "tain *evanida* for the southern and generally smoother form "either as a subspecies, which is perhaps preferable, or as a "variety."

This Chiton was numerous at both Robbins Island and Penguin, and from both places examples vary from those in which longitudinal ribbing is absent, through all stages of broken longitudinal ribbing to those in which these ribs traverse the whole area. One example taken at Penguin has distinctly coarser sculpture than is exhibited in a perfect, well-grown specimen taken by the writer at the Quarantine Station, Port Jackson, in 1918. Iredale and Hull recognise two full species, *australis* and *evanida*, and two subspecies, *divaricata* and *novæ-hollandiæ*. The examination of the material before me does not, in my opinion, justify such treatment. It is noteworthy that the juveniles of all are identical.

Stenochiton cymodocialis, Ashby, 1918.

Several examples of this shell were taken at Robbins Island on a small bed of the Sea Grass *Cymodocea*, and about a score taken on the cylindrical stems of the same plant at Penguin. The examples exhibit the variation characteristic of the species; the largest was from Robbins Island, and measures 13.5 mm. in length.

This is the first record of the occurrence of a member of this genus on the Tasmanian coast line, and one example of *S. longicymba* is credited by Blainville to King Island. This is discussed later.

Subfamily CALLISTOPLACINAE, Pilsbry, 1892.

Pilsbry associated with his genus *Callistochiton*, *Nuttallina*, *Craspedochiton*, *Angasia*, *Callistoplax*, and *Ceratozona* under the subfamily name *Callistoplacinæ*. Thiele removed *Craspedochiton* into his subfamily *Acanthochitoninæ*, though, as I have elsewhere shown, probably through mistaken identity, he was unacquainted with its true characters. Thiele then placed *Callistochiton* under the subfamily *Ischnochitonina* immediately following his genus *Tonicina*. It seems to me that the issues involved need additional research, basing such revision on the combined characters of the insertion plate and the radula. It seems that no one has up to the present attempted or been qualified to codify the classification of Polyplacophora on the basis of these dual taxonomic features; therefore, as far as possible one attempts to correlate existing taxonomic work rather than make rash departures. The peculiar "festooned" character of the insertion plate in *Callistochiton*, which was pointed out by Pilsbry, seems, failing the production of evidence to the contrary, sufficient grounds for the preservation of Pilsbry's name of *Callistoplacinæ*, but if the genus *Callistoplax* is definitely removed from association with the genus *Callistochiton*, then we must introduce the name *Callistochitoninæ*.

Genus *Callistochiton*, Carpenter, 1882.

Callistochiton meridionalis, Ashby, 1918.

One example of the variety of this species, described by the writer under the name *mayi*, was taken at Penguin and measured 20 mm. in length. This variety in which the reticulate sculpture of the very juvenile shell is retained beyond that stage of growth, seems peculiar to the N.W. Tasmanian coast.

Family CHITONIDÆ, Pilsbry, 1892.

Subfamily CHITONINÆ, Pilsbry, 1892.

Genus *Chiton*, Linne.

Subgenus *Rhyssoplax*, Thiele, 1893.

Chiton (*Rhyssoplax*) *oruktus*, Maughan, 1900.

One example only was taken in a deep hole far out on the reef below the Manager's House. Through a mischance this particular reef was but superficially examined. The discovery of this shell was not noted until all arrangements had been made for the party's departure to Penguin; its occurrence here may be taken as an indication that this spot will justify a more exhaustive examination and may yield some surprises.

Chiton (*Rhyssoplax*) *calliozona*, Pilsbry, 1894.

In the Smith collection before referred to, were two specimens of this shell. The one in the writer's collection is curled and would measure, if flat, 30 to 40 mm. in length. Both are interesting in having extensive areas of the shell coloured dark brown. The general colour varies from a greenish tinge to various shades of drab, the general effect being much paler than is this species in South Australia. It was probably collected at Stanley. It has rarely been taken in Tasmania, and then only on the northern coast.

Subgenus *Sypharochiton*, Thiele, 1893.

The writer, in common with many other conchologists, has in the past been in the habit of following Iredale's dictum in the giving of generic rank to names originally proposed as of subgeneric value only.

Thiele, neither in his original work (Das Gebiss der Schnecken, ii., p. 365), nor in his later one (Revis. des Syst. der Chitonen) considered either of his genera *Rhyssoplax* or *Sypharochiton* to rank other than subgenera or sections. He defines their distinguishing characters chiefly on the radula, and as far as we are aware, no one has since carried the study of Chiton radula further. While writers may be justified in adopting his divisions on the data he supplies, I fail to see why, without defining additional generic factors, anyone is justified in following Iredale and Hull in according full generic rank to these groups.

Chiton (*Sypharochiton*) *pellis-serpentis*, Quoy and Gaimard, 1835.

This species was very common at Robbins Island, Penguin, and Port Sorell. A fine series was taken varying

from shells in which the pleural area had no longitudinal ribbing, to those that possessed coarse almost beaded longitudinal ribbing. Some of the specimens certainly can be paired with examples from New South Wales. The writer in his paper on the Chiton fauna of Port Stephens in that State uses the following words in connection with this species: "Messrs. Iredale and May distinguished the Tasmanian "forms of this shell, under the designation of *Maugeanus:* "while I think the better way would be to consider them "mere varieties of the New Zealand shell, if students prefer "to consider the Tasmanian shell a geographic race, I suggest "that the somewhat more highly sculptured form found in "New South Wales be distinguished by the subspecific name "*septentriones*, a name suggested by the more northern habi- "tat." The results of a joint examination by W. L. May and the writer, as to the validity of separating the Tasmanian, New South Wales, and New Zealand shells from one another was published in Trans. Roy. Soc. S. Aust., vol. xlvi., 1922, p. 21. The following quotation will suffice: "We can- "not agree with Iredale and May in separating the Tasmanian "shells from the New Zealand ones, or from those from New "South Wales. Pilsbry, in his paper on 'Port Jackson "Chitons' (1894), also states that he was unable to detect "any difference between New South Wales and New Zea- "land shells, therefore *S. maugeanus*, Iredale and May, be- "comes a synonym of *S. pellis-serpentis*, Quoy and Gaimard." Iredale and Hull now do not recognise *S. pellis-serpentis* as an Australian species and grant full specific rank to *maugeanus* and *septentriones* as representing the Tasmanian and New South Wales shells respectively, which is a course which I consider is without any justification whatsoever.

Lepidopleurus variegatus, H. Adams and Angas, P.Z.S., 1864, 192.

Iredale and Hull (in Aust. Zool., vol. iii., pt. vi., 1924) propose to recognise this species in *Ischnochiton atkinsoni lincolnensis*, Ashby (Trans. Roy. Soc. S. Aust., xliv., 1920, p. 275, pl. xii.). The type figured and described was from Port Lincoln, South Australia, and not San Remo, Victoria, etc., as quoted. Iredale and Hull state "The type of *I. variegatus* "is at present missing, but we figure a neotype collected for "us by Mr. E. H. Matthews, at Minlacowie, Hardwicke Bay, "South Australia, the exact locality whence Angas describ- "ed it." They do not supply the slightest justification for their assertion that the specimen described by Adams and Angas came from Minlacowie, Hardwicke Bay, Spencer's

Gulf. The habitat as given in the type description as quoted by Pilsbry is "Yorke's (correctly spelt without the s) Penin-"sula, S. Australia, under stones at low water (Angas)." The habitats of *Hanleya variabilis*, A. and A., and *Lepidopleurus liratus*, Ad. and Ang. are also given in the same words. I have been informed that Angas did a good deal of collecting near Edithburg, on Gulf St. Vincent opposite to Adelaide, Yorke Peninsula, and we have hitherto believed that that was the type locality for the three species named.

Iredale and Hull further remark: "This species was "well described but not figured, and was recognised by Pils-"bry, Bednall, Matthews, and Torr, but Ashby, through an "oversight, neglected it, and re-described it as a form of *I. "atkinsoni*, I. and May, naming it *I. a. lincolnensis*." The facts are that Ashby left it out of his consideration because he was aware that Pilsbry placed *L. variegatus*, Ad. and Ang., under his list of "Insufficiently described Chitons," and that Bednall personally considered it a variety of *I. crispus* now *lineolatus*, Bl., and that Torr was of the same opinion. The only oversight was in making no mention of so discredited a name.

Reasons for not accepting *I. variegatus*.

(a) The type specimen was never figured.

(b) The type was lost.

(c) The description is insufficient for determination, as distinguishing specific characters are not given. It will apply equally as well to varieties of the common *I. lineolatus* as to *lincolnensis*.

(d) Bednall's, l.c. p. 146, adds no information to the original description beyond colour patterns, which are not determining factors in specific separation. He alleges that, having sent examples, Pilsbry approved of the identification, but does not quote him as having given any reasons for same.

Matthews has not as far as I am aware published anything *re* same. Torr (Trans. Roy. Soc. S. Aust., vol. xxxvi., 1912) states in reference to *varicgatus*: "It is probably a "cream coloured variety of *crispus*"=*I. lineolatus*.

(e) The writer has found both *I. lineolatus*, Bl., and *I. a. lincolnensis*, Ashby, living together in equally plentiful numbers on the coast of Yorke Peninsula within a few miles of Edithburg.

The only determining factor in the separating of these two very variable species is the size and fluting of the girdle

scales, a feature that was unrecognised and completely ignored as a means of comparison in the original description and by Bednall and Torr. For convenience it will be more satisfactory to consider *Lepidopleurus variegatus*, Ad. and Ang., as a synonym of *I. lineolatus*, as representing one of its varietal forms.

Ischnochiton atkinsoni, Ire. and May, and *I. a. lincolnensis*, Ashby, discussed.

Iredale and Hull l.c. accept two species describing one under the *I. variegatus=I. a. lincolnensis* on page 230 and *I. atkinsoni* on page 237. The descriptions will do equally well for either with the following exceptions:—

(a) They introduce nine species between their description of the South Australian shell and that of the N.W. Tasmanian shell.

(b) They refer to a colour distinction which is most inconstant, more often absent than present.

(c) *Variegatus* is described as "semi-carinated" and *atkinsoni* is described as "round-backed, not carin-"ated."

(a) Needs no discussion. (b) Of the 19 specimens on my card from the type locality of *lincolnensis*, i.e., Port Lincoln, in South Australia, less than half of the examples possess the lateral banding they refer to, and they vary in colour from almost white through shades of biscuit colour to the orange rufous that is so common in examples of *atkinsoni* from N.W. Tasmania; in other parts of South Australia and Victoria the variation of colour, pattern, and absence of pattern is much greater still. (c) In some of the Port Lincoln examples, especially near the beak, the jugum is slightly raised "semi-carinated," in others the shell is "round-backed not carinated," but this "semi-cari-"nation" is also met with, although more rarely, in examples from N.W. Tasmania. Thus we have to admit that this slight variation is neither of specific nor subspecific importance and *lincolnensis* is conspecific with *I. atkinsoni*, Ire. and May.

Ischnochiton atkinsoni bruniensis, n. subsp.

On collecting a good series at Robbins Island and Penguin, the type locality (Sulphur Creek is a local name of a suburb), we noticed at once the resemblance to some of the Mainland forms heretofore recognised under the subspecific name of *lincolnensis*. The mistake had occurred in this

way. The only available co-types of *atkinsoni* were more or less eroded, and although W. L. May in 1917 picked out two or three from examples of the original lot of Port Lincoln specimens, which he considered as "typical" of the Tasmanian *atkinsoni*, when early in 1920, he, with the writer, collected a long series of *atkinsoni* in the D'Entrecasteaux Channel, Southern Tasmania, it became possible to compare the Port Lincoln shells with these, when the subspecific differences were defined in the writer's paper (Trans. Roy. Soc. S. Austr., xliv., 1920, pp. 275-276).

It is now clear that the shells from D'Entrecasteaux Channel were not typical *atkinsoni* and require a subspecific name, I therefore suggest *bruniensis* after the Island from which the earliest specimens were collected. A slight amendment of the description l.c. will meet the case. By substituting for the words "Tasmanian shell" Bruny Island shell, and for the words "Mainland shell," *I. atkinsoni*, Ire. and May, we have the following definition: "Under a simple lens the "rugged character of the sculpture of the Bruny Island "shell is most consistent, whereas *I. atkinsoni* s.s., always "seems to have a polished appearance, and the granulose "sculpture is less in evidence." Iredale and Hull, in their description of *I. atkinsoni*, l.c. p. 237, use the words "central "areas coarsely quincuncially granulose, granules rounded "and flat-topped." In the definition of *bruniensis* as compared with *atkinsoni* s.s., the word very, must be inserted and read as follows: "Pleural area in median valves, very coarse-"ly quincuncially granulose, granules round and convex, not "flat-topped, the interspaces being much deeper than in *at-"kinsoni* s.s." The coarse nodulose radials referred to in the type description of the lateral areas of *I. atkinsoni* are as variable in that species, whether from the mainland or from N.W. Tasmania, as they are in *bruniensis*. The specimen I have selected as type comes from Lunawanna, Bruny Island, and measures 12.5 x 6 mm. There is no doubt in the writer's mind that if the eleven examples on card examined were mixed up with any number of *atkinsoni* from either side of Bass Strait, the specimens from Bruny Island could easily be sorted out. Its treatment as a subspecies seems well justified, but if, later, intermediates are discovered, it would have to be treated as a variety, occurring at the southern extremity of the range of *atkinsoni*.

Genus *Stenochiton*, Ad. and Ang., 1864.

Pilsbry considered *Stenochiton* deserving of subgeneric rank. In his paper on this genus (Trans. Roy. Soc. S.

Austr., vol. xlii., 1918), the writer proposed the elevation of *Stenochiton* to full generic rank on external and internal grounds. In the Classification List in "Victorian Naturalist," vol. xliii., No. 1, issued May, 1926, he only ranked it as a subgenus of genus *Ischnochiton*, because in the face of a number of new genera proposed by Iredale and Hull, many of which, in the writer's opinion, are unsupported by any true generic definitions, he preferred to review the position he took in his Monograph l.c. Now, having reviewed the position, he confirms his original opinion, supported as it is by the multislitting of the insertion plates, often in the median valves as well as in the end valves, and the specialised character of the shell.

Stenochiton posidonialis, Ashby, 1918

=*S. pilsbryanus*, of Iredale and Hull.

The writer in his paper on the genus *Stenochiton* l.c. showed that Bednall's figures and description of his *S. pilsbryanus* (Proc. Mal. Soc. Lon., vol. 2, pt. 4, 1897, pp. 142-3) not only could not be identified with the above, but did not coincide with any known form. The fact that collectors had sent away specimens of *S. posidonialis* under the name *S. pilsbryanus* did not, in his opinion, seem to affect the question. He showed both by description and figures, that in *S. posidonialis* the anterior valve is concave and not convex as stated by Bednall, also that in *S. posidonialis* the tail valve is very flat, entirely different from the figure of that valve as supplied by Bednall in his type description. The suggestion made by Iredale and Hull that juvenile shells of *S. posidonialis* may not show any concavity in the anterior valve is not supported by an examination of a number of specimens of a similar size to Bednall's type, viz., 5.75 mm., as all have exhibited this feature.

The writer would have liked to find a way out of the dilemma both in accordance with the wishes of Dr. H. A. Pilsbry and in harmony with the International Rules, and will reserve a final review of this problem till a later date.

Stenochiton tatei, n.sp.

Stenochiton tatei, Ashby, a new name for the shell described by Ashby under the name *Stenochiton* (*Zostericola*) *pilsbryanus*, Bednall (Trans. Roy. Soc. S. Austr., vol. xliii., 1919, pp. 66-69, pl. xi., figs. 2, 2a, 2b, 2c).

The writer has always been in doubt as to the validity of his having attached the name of *S. pilsbryanus*, Bed., to the new species he described in 1919 (l.c.), it having been

done with the desire of preserving that name in connection with a valid species. The refusal of Iredale and Hull to accept that course reopens the question, and I take this opportunity for supplying a new name for the shell then described under the name *Stenochiton* (*Zostericola*) *pilsbryanus*, Bed.

In my paper (l.c.) it was pointed out that the species under description was broad and short, instead of, as is the case in other known forms belonging to this genus, being "long and narrow," and because of this fact suggested the subgeneric name of *Zostericola* for its reception, but on further consideration it would seem better to enlarge slightly the conception of the genus *Stenochiton*, by slight emendations and the insertion of the word "usually" into Adam and Angas's Definition thus—*Amended Definition of genus Stenochiton*: Shell unusually elongated, highly polished, almost unsculptured; convex, i.e., rounded or arched as distinct from carinated, plates of insertion small, multifissate in end valves and usually more than one slit in median valves; girdle covered with minute, polished, imbricating scales; living on Sea-Grasses.

It is not necessary to repeat the description published by the writer under the name *S. Z. pilsbryanus*, Bed., l.c., as that now becomes the type description of *Stenochiton tatei*, Ashby, and the example figured and described becomes the type. But the following comments and data are supplied as supplementary to that description. The dried type of *S. tatei* measured 5.5 x 3 mm., but if well preserved probably would have measured 6 x 3.5 mm. It has every appearance of being an adult shell. Iredale and Hull under *Stenochiton pilsbryanus*, p. 286 l.c., include "*?Zostericola pilsbryanus*, "Ashby"; adding the note, "Which may be a juvenile example "of *S. pallens*." If they had taken the trouble to compare the co-type of *pallens*, which they had had on loan, with the photo accompanying the description of this species, they would at once have seen that the peculiar elongation and tapering of the tail valve of *pallens* was entirely absent, for while the photo is not first class, it sufficiently demonstrates this fact.

Stenochiton longicymba, Blainville, 1825.

Chiton longicymba, Blain. Dict. Sci. Nat., vol. xxxvi., p. 542.

Stenochiton juloides, Ad. and Ang. (Proc. Zool. Soc., 1864, p. 193).

In Proc. Mal. Soc. Lon., vol. xv., pt. v., June, 1923, was published a paper by the writer entitled "Notes on the genus

"*Stenochiton* and the discovery and recognition of the type of "Blainville's *Chiton longicymba* in *Stenochiton juloides*, Ad. "and Ang." In it he referred to Thiele's description of a Chiton mounted on a card in the Paris Museum and labelled *Schizochiton nympha*, Rochebrune. Thiele identified it with the genus *Stenochiton*, but expressed his opinion that it was not conspecific with either *juloides* or *pallens*. Ashby then quoted as follows from "Misnamed Tasmanian Chitons," Iredale and May: "There is certainty that Rochebrune renamed "the Blainvillean species, and that *Chiton longicymba*, Blain- "ville, is a *Stenochiton*. Thiele does not definitely make this "a synonym of *Stenochiton juloides*, Ad. and Ang., and until "King Island specimens are again collected, we prefer to "allow *Stenochiton longicymba*, Blain., as a separate species." Ashby then gave details of his comparison of the type of *S. nympha*, Roch., with examples of *juloides*, and points out that the specimen belongs to that form of *juloides* that is "variegated or streaked with white," as is so well expressed in Blainville's description. Iredale and Hull, in their paper entitled "A Monograph of the Australian Loricates," l.c., Oct., 1924, do not refer in any way to Ashby's paper or his identification of Blainville's species with *S. juloides*, Ad. and Ang., neither do they supply a reference to the paper which was read in March, 1923, and of which Iredale had early advice. They remark on page 285 l.c., "Iredale and "May, familiar with Rochebrune's idiosyncrasies, recognised "in Thiele's figures the long lost *longicymba* of Blainville. "As Hull and Ashby did not meet with the species on King "Island, and Hull found it very common at King George "Sound, W. Aust., Hull suggested that the latter locality was "the source of Péron's specimen." They then state: "Ile "King, errore=Kangaroo Is." In the first place, Ashby was never in King Island, and the only published reference to the possibility of the type having come from Western Australia is in a paper giving the results of the collecting trip to King Island of May, followed later by Hull (Aust. Zool., vol. iii., pt. ii., issued March, 1923, by Ashby and Hull).

I strongly dissent from the attempt to remove this interesting species from the recorded fauna of Tasmania on the following grounds:—

(1) It was absolutely impossible for either May or Hull to have made an exhaustive investigation of such a large field as King Island within the limits of the time available to them.

(2) Hull noted beds of the sea-grass *Cymodocea*, but found no examples of *S. cymodocialis*, but we are certainly justified in assuming its presence there, now that the writer and May have discovered this species both at Robbins Island and at Penguin on the North-West Coast of Tasmania. Here it was overlooked by both Torr and Atkinson, who both did much collecting at the latter place.

(3) For example.—*Ischnochiton lineolatus*, Blain., which was described as from King Island, was quite rare at the three reefs worked jointly by May, Coleman, and Ashby at Robbins Island, but on the Eastern reef near Homestead, Ashby found it in very large numbers. Port Stephens in N.S.W. had been examined by both Brazier and Hull, who reported it very poor in Chiton fauna, whereas Thackway, May, and the writer, in 1923, located a spot there which was extremely rich in this fauna, one of the richest in Chiton fauna in that State.

These illustrations will suffice to show the unwisdom of disallowing King Island as the type locality for *Stenochiton longicymba*, on such slender evidence.

ECOLOGY AND RANGE OF HABITAT.

S. cymodocealis, Ashby, living on the cylindrical stems of *cymodocea*, range extending from Penguin and Robbins Island in Tasmania, along the South Australian coast and up the western coast as far as Geraldton.

S. posidonialis, Ashby, living on the flat stems and leaves of *Posidonia*, chiefly just above the sand, range extending along the South Australian and Western Australian coast and up the West Coast as far as Dongarra.

S. longicymba, Blainville, living in the brown basal sheaves, buried in the sand, of *Posidonia*, range extending from King Island in Tasmania along the whole of the southern coast of Australia and up the west coast as far as Garden Island.

S. pallens, Ashby, a few examples only, dredged by Sir Joseph Verco in Gulf St. Vincent, and one dredged at Port Phillip Heads in Victoria.

S. tatei, Ashby, type off *Zostera ? Posidonia*, Troubridge Shoal, Gulf St. Vincent, and ? one juvenile off *Posidonia* in the same Gulf.

Probably the whole of these species extend into the North Tasmanian Region.

A SHORT KEY TO SPECIES OF STENOCHITON.

Head valve, anterior slope slightly to strongly convex	*longicymba, cymodocealis, pallens, tatei.*
Head valve, anterior slope concave	*posidonialis.*
Tail valve elevated	*cymodocialis, longicymba, tatei, pallens.*
Tail valve shallow, flat, slightly concave	*posidonialis.*
Tail valve exceptionally long and tapering	*pallens.*
Tail valve short and rounded	*tatei.*
Mucro anterior to central ..	*cymodocealis, tatei, posidonialis* (anterior third example 5.5 mm. long).
Mucro posterior	*longicymba, pallens* (posterior third in co-type).

A NOTE ON *EUCALYPTUS JOHNSTONI*, MAIDEN.

By

L. Rodway, C.M.G.

(Read 20th December, 1926.)

Some years ago Mr. T. B. Moore discovered, on the range between New Norfolk and the Huon district, a Gum-tree which appeared to be somewhat different from any with which he was acquainted. He described it in the Papers and Proceedings of the Royal Society of Tasmania, 1886, page 207, giving it the name *Euc. muelleri.* This name was unfortunate, as Miquel had already applied it to a form of *Euc. dumosa,* and Naudin had used it for a variety of *Euc. ovata.* Maiden refers to it in the Critical Revision, Vol. 3, p. 160.

The name was allowed to remain till Maiden in the Revision, Vol. 6, p. 280, replaced it by *Euc. johnstoni* as some small recognition of the work done in botanical science by Robert Mackenzie Johnston.

The tree has since been observed on Mount Wellington, Mount Field, and many peaks to the west. It is not a good species, for though its typical form appears fairly distinct, yet every intervening condition between that and *Euc. gunnii* may often be met with. It appears as a zone at about two thousand feet altitude. In suitable habitat it becomes a noble tree, and produces an excellent timber of a pinkish colour. Fissile, heavy, and tough, it is eminently suitable for tool-handles, shafts, oars, and such, and should return excellent results if cultivated under proper conditions.

Locally it is commonly called Brown Gum.

NEW AND LITTLE-KNOWN TASMANIAN LEPIDOPTERA.

Part II.

By

A. Jefferis Turner, M.D., F.E.S., Brisbane.

(Read 20th December, 1926.)

Fam. ARCTIADÆ.

Amsacta eurymochla, n.sp.

εὐρυμοχλος, broadly barred.

♂. 48 mm. Head orange; face white. Palpi blackish; ochreous beneath towards base. Antennæ blackish; in ♂ very shortly bipectinate (½), becoming simple towards apex. Thorax white, with a longitudinal central blackish bar not reaching margins, and short lateral bars on shoulders. Abdomen orange above; white beneath; transverse blackish dorsal and ventral bars on each segment. Legs blackish; femora orange on dorsum, white beneath. Forewings triangular, costa straight to ¾, slightly arched posteriorly, apex round-pointed, termen slightly rounded, oblique; white; a blackish costal line almost to apex; extreme apex of costa orange; an orange subcostal line to ¾; a blackish line from near base, narrowly separate from preceding, to costa beyond it, expanded and giving rise to several dentate projections at its termination before apex; a median line confluent at base with preceding, and connected to it by a transverse bar at end of cell, there dividing into four lines along veins to termen; a subdorsal line from base to tornus, broadening and becoming dorsal before middle; cilia white. Hindwings with termen rounded; as forewings but without orange line; blackish lines broadly suffused.

This has probably been regarded as a form of *A. marginata*, and perhaps the Tasmanian record for that species has so arisen. To me it appears a distinct though allied species. In addition to the very distinct markings the forewings are shorter and broader.

Beaconsfield; two specimens received from Mr. W. B. Barnard, who has the type.

Fam. PHYCITIDÆ.

Ephestia cautella, Wlk.

Syn. *ficulella*, Barrett.

This species has now a worldwide distribution. It has been confused with *E. elutella*, Hb., of which I have not yet seen an authentic Australian example.

Ephestia kuehniella, Zel.

Very similar to the preceding. The distinguishing characters are well given by Meyrick in his "Handbook of British Lepidoptera." Not previously recorded from Australia, but I found two examples in the Littler collection.

Plodia interpunctella, Hb.

Another very widely distributed species. Like the two preceding it feeds on flour, maize, dried fruits, etc.

Fam. CRAMBIDÆ.

Platytes contempta, n.sp.

contemptus, despised.

♀. 24 mm. Head and thorax pale-brown. Palpi 7; pale-brown irrorated with fuscous, lower edge whitish. Antennæ brown-whitish. Abdomen whitish. Legs brown-whitish. Forewings narrow, posteriorly dilated, costa nearly straight, apex round-pointed, termen nearly straight, slightly oblique; pale-brown; an indistinct double discal dot at 2/3; a broad paler terminal fascia; cilia pale-brown. Hindwings over 2, termen slightly sinuate; whitish; cilia whitish.

Moina, Cradle Mountain Road (2,000 ft.), in January (W. B. Barnard); one specimen.

Fam. CARPOSINIDÆ.

Paramorpha eburneola, n.sp.

eburneolus, made of ivory.

♂. 16 mm. Head and thorax white. Palpi 6; white, basal half of lower edge dark-fuscous. Antennæ grey, becoming white towards base; ciliations in ♂ 1. Abdomen grey. Legs grey; posterior pair white. Forewings elongate, somewhat dilated, costa moderately arched, apex acute, termen nearly straight, strongly oblique; white with a very few scattered dark-fuscous scales; a pair of blackish discal dots at 2/3, one at each posterior angle of cell; a series of blackish dots around apex and on termen, those around apex larger; cilia pale-grey, on tornus white. Hindwings with termen sinuate; white; cilia white.

Allied to *P. rhachias*, Meyr., and *P. aquilana*, Meyr., distinguished by its white colour, total absence of costal strigulæ, and discrete blackish terminal dots.

Rosebery in February; one specimen.

Fam. TORTRICIDÆ.

Acropolitis ergophora, Meyr.

♂. 23-26 mm. ♀. 26-30 mm. Palpi in ♂ 2; in ♀ 2½. Antennæ of ♂ shortly obtusely dentate beyond middle, ciliations 1¼. Forewings in ♂ with fold moderately broad, reaching to 1/3.

Acropolitis ptychosema, n.sp.

πτυχοσημος, marked on the fold.

♂. 28-30 mm. Head and thorax grey; face fuscous. Palpi 3; fuscous; base and most of internal surface whitish. Antennæ fuscous; in ♂ slightly dentate, ciliations 1. Abdomen pale-grey. Legs fuscous mixed with whitish; tarsi annulated with whitish; posterior pair mostly whitish. Forewings suboblong, costa moderately arched, apex rectangular, termen rounded, slightly oblique; costal fold in ♂ moderately broad, reaching to 1/3; grey with patchy ferruginous irroration; no defined basal patch, median fascia, or costal triangle, but the latter two may be indicated by some darker grey suffusion on costa; a series of fuscous and ferruginous costal dots or short strigulæ; a blackish line on subdorsal fold from near base to middle, surrounded by some ferruginous suffusion; a short blackish median line from 1/3 not reaching 2/3, edged beneath with ferruginous, sometimes surrounded by dark-grey suffusion; sometimes an incomplete series of ferruginous strigulæ from 2/3 costa to termen above tornus; terminal edge interruptedly fuscous; cilia whitish-grey, sometimes suffused with ferruginous, sometimes with a few fuscous dots. Hindwings with termen slightly sinuate; 6 and 7 connate; pale-grey with transverse strigulæ of darker grey especially towards apex.

Characterised by the obsolescence of usual markings and ferruginous suffusion of forewings, and especially by the blackish streak on fold.

Cradle Mountain (3,000 ft.) in January; two specimens.

Gen. PARAPHYAS, nov.

παραφυας, an offshoot.

Palpi very long (over 6), porrect; second joint very long, shortly rough-scaled; terminal joint moderate. Fore-

wings with 7, 8, 9 long-stalked, 7 to termen. Hindwings with 3 and 4 connate, 5 curved and approximated to 4 at origin, 6 and 7 stalked.

Directly developed from *Capua*, from which it differs in the very long palpi, and stalking of 9 of forewings. The latter structure, rare in this family, has developed independently in several unrelated genera.

Paraphyas callixena, n.sp.

καλλιξενος, a pretty stranger.

♀. 18 mm. Head and thorax grey-whitish. Palpi 8; whitish, lower edge and apex fuscous. Antennæ pale-grey. Abdomen ochreous-whitish, Legs fuscous; posterior pair ochreous-whitish. Forewings dilated posteriorly, costa gently arched, apex round-pointed, termen straight, oblique; white; many, very fine, long, grey, transverse strigulæ from dorsum; a dark-fuscous basal costal dot; a triangular fuscous blotch on costa from 1/5 to 3/5, reaching rather less than half across disc, where its lower angle is obtusely truncated; a small, acute, fuscous, costal triangle at 4/5, giving rise to a grey line, or series of strigulæ, to 4/5 dorsum; a subterminal series of grey strigulæ; some small fuscous terminal dots; cilia fuscous, apices whitish. Hindwings with termen sinuate; grey-whitish; cilia grey, becoming whitish on dorsum.

Rosebery in February; one specimen.

Capua poliobaphes, n.sp.

πολιοβαφης, dyed grey.

♂. 18 mm. Head ochreous-whitish. Palpi 1½; fuscous; internal surface and upper edge ochreous-whitish. Antennæ grey; in ♂ slightly serrate, ciliations ½. Thorax and abdomen grey. Legs fuscous; tarsi annulated with ochreous-whitish; posterior pair except tarsi ochreous-whitish. Forewings subtriangular, costa moderately arched, apex pointed, termen nearly straight, slightly oblique; costal fold in ♂ narrow, reaching to middle; pale-grey sometimes slightly ochreous-tinged, more or less dotted with fuscous; a dorsal series of fuscous dots; a dark-fuscous discal spot at ⅔, sometimes divided into two dots; cilia ochreous-whitish, bases dark-fuscous. Hindwings with termen scarcely sinuate; 3 and 4 connate; grey-whitish with broad grey transverse strigulation; cilia grey-whitish.

Hobart and Mt. Wellington (2,500 ft.) in January (W. B. Barnard); two specimens.

Capua asemantica, n.sp.

ἀσημαντικος, insignificant.

♂. 14 mm. Head ochreous-whitish. Palpi 2; ochreous-whitish with a few fuscous scales. Antennæ grey; in ♂ slightly serrate, ciliations ½. Thorax and abdomen dark-grey; tuft ochreous-whitish. Legs fuscous; tarsi annulated with ochreous-whitish; posterior pair ochreous-whitish. Forewings subtriangular, rather narrow, apex pointed, termen nearly straight, oblique; costal fold in ♂ narrow, reaching 2/5; whitish; a series of dark-fuscous dots on costa and dorsum; a slender blackish median longitudinal line from 2/5 to 3/5; immediately beyond this a large defined square or triangular fuscous subapical costal spot, mixed with blackish; a fine blackish submarginal line or series of strigulæ before termen; cilia whitish-brown, bases partly fuscous. Hindwings with termen scarely sinuate; 3 and 4 connate; pale-grey sometimes with faintly darker strigulæ; cilia grey-whitish.

Allied to the preceding. As both are probably variable, it should be noted that this is considerably smaller, the forewings narrower, their termen more oblique, and the costal fold shorter.

Wilmot in January; Burnie in February; two specimens probably taken among tree-ferns.

Capua nimbosa, n.sp.

nimbosus, darkly clouded.

♀. 16 mm. Head brown-whitish. Palpi 2½; brown-whitish. Antennæ grey, towards base brown-whitish. Thorax brown. Abdomen dark-grey; tuft in ♀ very large. Legs ochreous-whitish; anterior pair partly fuscous. Forewings broadly triangular, costa rather strongly arched, apex pointed, termen nearly straight, oblique; whitish with grey transverse strigulæ; basal patch and median fascia grey, ochreous-tinged; basal patch well defined, posterior margin nearly straight; fascia from middle of costa, moderately broad on costa, greatly dilated towards tornus, but not quite reaching termen, anterior edge ill defined, posterior distinct, at first outwardly oblique, then curved parallel to and very near termen; a rounded dark-fuscous costal triangle from 2/3 to near apex, containing a white costal dot in middle; cilia grey with a subterminal dark-fuscous line. Hindwings with termen scarcely sinuate; 3 and 4 stalked; dark-grey; cilia grey.

Allied to *C. euphona;* characterised by the broad forewings, defined basal patch, very broadly dilated fascia, and dark-fuscous costal triangle.

Rosebery in February (W. B. Barnard); one specimen. There is also one example from Launceston in the Littler Collection.

Capua eugrapta, n.sp.

εὐγραπτος, distinctly marked.

♂. 14-16 mm. Head fuscous. Palpi 3; fuscous. Antennæ fuscous; ciliations in ♂ ¼. Thorax pale-brown with a few fuscous scales. Abdomen grey; tuft whitish-ochreous. Legs fuscous; tarsi annulated with whitish-ochreous; posterior pair whitish-ochreous. Forewings narrow, suboblong, costa gently arched, apex pointed, termen straight, oblique; costal fold in ♂ narrow, reaching 2/5; pale-brown; markings dark-brown mixed with blackish; a stout bar from base of dorsum to middle of disc at ⅓; a rather narrow oblique fascia from costa before middle to dorsum before tornus, rather constricted in middle; a moderate costal triangle from 3/5 to near apex; a terminal fascia from beneath apex, sometimes confluent with first fascia at tornus; cilia pale-brown, bases sometimes darker, on apex sometimes with fuscous apices. Hindwings with termen slightly sinuate; 3 and 4 connate or stalked; whitish-grey with indistinct darker transverse strigulation; cilia whitish-grey.

Strahan in February; four specimens.

Capua thaleropis, n.sp.

θαλερωπις, fresh-looking.

♀. 15-16 mm. Head grey. Palpi 2½; grey. Antennæ fuscous with pale annulations. Thorax reddish-brown. Abdomen grey. Legs fuscous; tarsi annulated with ochreous-whitish; posterior pair ochreous-whitish. Forewings narrow, suboblong, costa moderately arched before middle, thence sinuate, apex round-pointed, termen nearly straight, oblique; reddish-brown; some dark-fuscous costal dots; a costal suffused triangular spot of darker brown sometimes mixed with blackish; cilia reddish-brown, apices paler. Hindwings with termen sinuate; 3 and 4 connate or stalked; pale-grey with faint darker transverse strigulation; cilia pale-grey.

Rosebery and Strahan in February; two specimens.

Capua cirrhoptera, n.sp.

κιρρόπτερος, yellowish-winged.

♂. 14-15 mm. Head and thorax ochreous-brown. Palpi 6; ochreous-brown. Antennæ ochreous-brown; in ♂ with tufts of long cilia (3). Legs fuscous; posterior pair ochreous-whitish. Forewings subtriangular, costa slightly arch-

ed towards base, thence nearly straight, apex pointed, termen sinuate, only slightly oblique; in ♂ without costal fold; pale ochreous-brown; terminal part of disc with some fuscous scales or dots, sometimes distinctly dotted; a fuscous discal dot at 2/3 on end of cell; cilia pale ochreous-brown. Hindwings with termen sinuate; 3 and 4 connate or closely approximated at origin; grey; cilia grey.

Cradle Mountain (3,000 ft.) in January; five specimens.

Gen. EPIPHYAS, nov.

ἐπιφυας, an offshoot.

Tongue present. Palpi moderately long, porrect; second joint with a triangular thickening of scales on upper surface; terminal joint short. Antennæ of ♂ ciliated. Thorax not crested. Forewings with all veins present and separate, 7 to termen. Hindwings with 3 and 4 stalked, or 4 absent, 5 approximated to 3 at origin, 6 and 7 separate, but approximated for some distance.

Type *E. eucyrta*. A derivative of *Tortrix*, from which it differs only in the stalking or coincidence of 3 and 4 of hindwings. In structure it approaches *Apinoglossa*, Möschler, in which the tongue is said to be absent; this genus is recorded from the West Indies, and is probably an independent derivative of *Tortrix*.

Epiphyas eucyrta, n.sp.

εὐκυρτος, well curved.

♂ ♀. 18-22 mm. Head and thorax reddish-brown. Palpi in ♂ 3, in ♀ 3½; reddish-brown. Antennæ whitish, towards apex grey; ciliations in ♂ 1. Abdomen whitish. Legs brown; posterior pair whitish. Forewings suboval, costa strongly arched, apex rounded, termen nearly straight, oblique; in ♂ without costal fold; reddish-brown, usually broadly suffused with brown-whitish towards costa and termen, numerous reddish-brown dots more apparent in suffused area; sometimes a brown-whitish rather broad suffusion on dorsum before middle; sometimes three or four blackish dots before termen; cilia brown-whitish. Hindwings with termen slightly sinuate; 3 and 4 coincident, whitish or grey-whitish with transverse grey strigulæ; cilia whitish.

Rosebery and Strahan in February; five specimens.

A fifth ♂ example from "Gravelly Beach" near Beaconsfield has the forewings brownish-grey with dark-fuscous marks on dorsum at 1/3 and 2/3, and in the hindwings 3 and 4 are stalked, but diverge very slightly. I believe it is an abnormal example of this species.

Epiphyas chlidana, n.sp.

χλιδανος, soft, delicate.

♀. 20 mm. Head and thorax whitish. Palpi 3½; grey-whitish. Antennæ grey-whitish. Abdomen whitish. Legs pale-grey; posterior pair whitish. Forewings suboval, costa rather strongly arched, apex pointed, termen slightly sinuate, oblique; pale brown; a whitish costal streak from base to middle; some whitish suffusion along dorsum; cilia whitish-grey, on apex brown, on costa whitish. Hindwings with termen sinuate; 3 and 4 long-stalked, widely diverging; pale-grey; cilia whitish with a pale-grey basal line.

Rosebery in February (W. B. Barnard); one specimen.

Tortrix incompta, n.sp.

incomptus, unadorned.

♂. 17-20 mm. Head fuscous sometimes mixed with ochreous. Palpi 2½; fuscous mixed with ochreous. Antennæ fuscous; ciliations in ♂ 3. Thorax and abdomen fuscous. Legs fuscous; posterior pair whitish-ochreous. Forewings elongate-triangular, costa slightly and uniformly arched, apex rounded-rectangular, termen slightly rounded, slightly oblique; costal fold in ♂ strongly developed, extending to middle; fuscous, often with slight whitish or ochreous irroration towards termen, rarely this irroration extends over whole wing, more frequently there is none of it; sometimes two or three pale-ochreous dots on costa before apex; cilia fuscous. Hindwings with termen sinuate; fuscous; cilia pale-fuscous with a darker sub-basal line.

Mt. Wellington (2,500 ft.) and Cradle Mountain (3,000 ft.) in January; seventeen specimens all of the same sex.

Tortrix hemiphœna, n.sp.

ἐμιφοινος, half-reddish.

♂. 24-25 mm. Head and thorax brown. Palpi 2½; brownish. Antennæ grey; in ♂ dentate, ciliations 2/3. Legs whitish-ochreous; tarsi fuscous annulated with whitish-ochreous; anterior pair mostly fuscous. Forewings suboblong, costa strongly arched to middle, thence straight, apex subrectangular, termen straight, rounded towards tornus, slightly oblique; costal fold in ♂ narrow and rudimentary, but extending to middle; ochreous-whitish, with reddish strigulæ; terminal 2/3 suffused with reddish or fuscous-reddish sharply limited by an oblique line from 1/3 costa to beyond mid-dorsum; a rather large, faintly darker, basal patch angled outwards beneath costa; central fascia represented by an oblique fuscous bar from 1/3 costa to above middle of disc, where it

is slightly enlarged and angulated outwards; costal triangle scarcely indicated; three transverse lines of fuscous strigulæ towards termen, first from before tornus; second from tornus, third from mid-termen, varying in length, but not reaching costa; cilia reddish, basally mixed with fuscous, apices paler. Hindwings with termen slightly sinuate; whitish coarsely strigulated with grey; whitish with a grey antemedian line, on apex tinged with reddish.

Russell Falls in January; Zeehan in February; two specimens.

Tortrix ophiosema, Low.

We took a small series of this species in fern-tree gullies at Russell Falls and Strahan. It varies in the degree of development of the dark markings on forewings, and the central fascia may be interrupted and partly obsolete, but it is always easily recognised. As all our examples are of the male sex, it is still unsettled whether it may not be the same species as *T. dotatana*, Wlk.

Tortrix euides, n.sp.

εὐειδης, handsome.

♂. 25 mm. Head fuscous. Palpi 4; fuscous mixed with whitish and a few reddish scales. Antennæ fuscous; in ♂ slightly dentate, ciliations ½. Thorax with a small posterior crest; fuscous mixed with reddish and suffused posteriorly with whitish. Abdomen fuscous. Legs fuscous; tarsi annulated with whitish; posterior pair almost wholly whitish. Forewings suboblong, costa slightly arched, apex rounded-rectangular, termen nearly straight, slightly oblique; in ♂ without costal fold; whitish strigulated and suffused with grey; markings dark-grey strigulated with dark-red; a moderate basal patch, its outer edge oblique and nearly straight, from 1/8 costa to 1/3 dorsum; central fascia represented by a large triangular costal blotch from ¼ to 2/3, doubly angled beneath, the anterior angle occupied by a dark-red spot; a terminal fascia, its anterior edge distinct, wavy, dark-red, from 7/8 costa to tornus, including a wavy, dark-red, transverse line; cilia whitish, with basal and subapical grey lines. Hindwings with termen slightly sinuate; pale-grey with darker strigulations; cilia as forewings.

Mount Wellington (2,500 ft.) in January (W. B. Barnard); one specimen.

Tortrix loxotoma, n.sp.

λοξοτομος, obliquely divided.

♂. 21 mm. Head grey-whitish. Palpi 3; fuscous, base and inner-surface whitish. Antennæ fuscous; in ♂ slightly

dentate, ciliations 1. Thorax ferruginous-fuscous suffused with grey-whitish. Abdomen grey. Legs fuscous; tarsi annulated with whitish; posterior pair whitish. Forewings suboblong, costa moderately arched, more so towards base, apex pointed, termen slightly rounded, slightly oblique; in ♂ without costal fold; pale-grey becoming whitish towards dorsum; markings ferruginous-fuscous; a small basal patch, its edge angulated outwards; central fascia narrow, from 2/5 costa to tornus; a small costal triangle before apex; a small terminal fascia narrowing to a point at apex and lost in suffusion towards tornus; terminal part of disc suffused with grey, which unites markings into a large terminal blotch; cilia whitish, with a basal line partly grey, partly ferruginous, on apex fuscous. Hindwings with termen sinuate; grey-whitish strigulated and suffused with grey; cilia whitish with a pale-grey sub-basal line.

Mount Wellington (2,500 ft.) in January (W. B. Barnard); one specimen.

Tortrix acrothecta, n.sp.

ἀκροθεκτος, with sharp apex.

♂. 20 mm. Head and thorax fuscous-brown. Palpi 1½; brown. Antennæ fuscous-brown; ciliations in ♂ 1. Abdomen grey, tuft paler. Legs ochreous-whitish; anterior pair fuscous. Forewings suboblong, costa strongly arched before middle, thence straight, apex acute, slightly produced, termen sinuate, scarcely oblique; in ♂ without costal fold; pale fuscous-brown with slightly darker strigulæ: basal patch and median fascia absent; a small equilateral fuscous triangle edged with blackish dots on 2/3 costa; several fine lines of fuscous strigulæ before termen; cilia fuscous, on apex and tornus brown. Hindwings with termen slightly sinuate; whitish strigulated and partly suffused with grey; cilia grey-whitish.

This species agrees with *T. ocyptera*, Meyr., in its peculiarly shaped forewings.

Mount Wellington (2,500 ft.) in January; one specimen.

Tortrix astathmeta, n.sp.

ἀσταθμητος, unstable.

♀. 15-20 mm. Head and thorax ochreous-brown. Palpi 2½; ochreous-brown, sometimes with a few fuscous scales. Antennæ fuscous-grey. Abdomen fuscous-grey; beneath ochreous. Legs brownish; posterior pair paler; anterior and middle tarsi fuscous with whitish annulations. Forewings suboblong, posteriorly dilated, costa arched near base, thence

sinuate, apex rounded-rectangular, termen sinuate, not oblique; pale-ochreous-brown, sometimes pinkish-tinged, sometimes largely suffused with orange-ochreous; markings extremely variable, usually indicated towards costal and dorsal margins only, sometimes wholly obsolete, sometimes dark and well-developed, dark reddish-brown, sometimes with a few similar strigulæ between and beyond them; basal patch slightly rounded, usually indistinct or obsolete; central fascia from 1/3 costa to ⅔ dorsum, narrow but occasionally slightly dilated toward dorsum, usually however obsolete except on costa, sometimes followed by a costal dot; costal triangle at 2/3, small but deep, not always present; cilia concolorous, sometimes blackish on and beneath apex. Hindwings with termen scarcely sinuate; pale-grey; apex ochreous-tinged; cilia pale-grey, towards apex whitish-ochreous.

Cradle Mountain (3,000 ft.) in January; fifteen specimens, all of the one sex. The shape of forewings is characteristic.

Tortrix polyphrica, n.sp.

πολυφρικος, much-rippled.

♂. 22 mm. Head and thorax grey. Palpi 2; grey. Antennæ fuscous; ciliations in ♂ 1. Abdomen pale-grey. Legs fuscous; tarsi with whitish annulations; posterior pair except tarsi whitish. Forewings suboblong, costa rather strongly arched, apex pointed, termen nearly straight, slightly oblique; costal fold in ♂ slight, reaching to ¼, triangularly dilated with long scales towards its apex; whitish, suffused with fuscous so as to appear grey; numerous fuscous dots on costa and in disc, some of them more or less connected to form imperfect wavy transverse lines or strigulæ; three larger spots in middle of disc at ¼, before middle, and at 2/3; cilia grey, sometimes with a few fuscous bars, bases white. Hindwings with termen sinuate; pale-grey; cilia whitish.

Cradle Mountain (3,000 ft.) in January; three specimens.

Tortrix alysidina, n.sp.

ἁλυσιδινος, made of chainwork.

♂. 24 mm. Head and thorax brown. Palpi 1½; brown. Antennæ brown; ciliations in ♂ 1. Abdomen pale-brown. Legs fuscous; posterior pair ochreous-whitish. Forewings suboblong, costa rather strongly arched, apex pointed, termen slightly sinuate, slightly oblique; costal fold in ♂ extremely rudimentary; brown; very numerous small fuscous dots arranged in rows between veins; a suffused fuscous longitudinal line above middle of disc from 1/3 to 2/3; cilia grey

with a basal brown line, apices pale-brownish. Hindwings with termen sinuate; pale-grey; cilia pale-grey, bases whitish.

Mt. Wellington (2,500 ft.) in January (W. B. Barnard); one specimen.

Tortrix schematica, n.sp.

σχηματικός, of distinctive pattern.

♂. 18-20 mm. Head and thorax fuscous. Palpi 2; grey-whitish. Antennæ fuscous; in ♂ minutely ciliated. Abdomen dark-grey. Legs fuscous; posterior pair ochreous-whitish. Forewings suboblong, costa gently arched before middle, thence straight, apex subrectangular, termen nearly straight, scarcely oblique; in ♂ without costal fold; ochreous-whitish with clearly defined fuscous markings; a moderate basal patch, its posterior edge slightly concave; a rectangular spot on costa at 1/3, widely separated from a larger similar spot on mid-dorsum; a triangular spot on 2/3 costa, its apex nearly or quite touching a large rectangular spot, which extends from tornus to middle of disc; a moderate terminal fascia becoming narrower beneath, where it joins tornal spot; cilia grey; apices whitish. Hindwings with termen scarcely sinuate; dark-grey; cilia grey.

Wilmot in January (W. B. Barnard); one specimen; a second example from Launceston in the Littler Collection.

Tortrix nephaula, Meyr.

Also from Mt. Erica, Victoria (Geo. Lyell).

Tortrix concinnula, n.sp.

concinnulus, rather neat.

♀. 13-14 mm. Head whitish-ochreous. Palpi 4; whitish-ochreous. Antennæ pale-grey with blackish rings. Thorax fuscous. Abdomen fuscous. Legs fuscous; posterior pair whitish. Forewings subtriangular, costa arched towards base, thence straight, apex pointed, termen straight, slightly oblique; white with slight fuscous irroration; markings fuscous mixed with brown; basal patch rather large but imperfectly developed, its posterior edge angulated outwards in middle; central fascia from 2/5 costa, moderately broad, oblique, dilated in disc, then narrowed almost to a point on 2/3 dorsum; a second fascia very broad on costa, where it encloses a central white dot, gradually narrowing but still moderately broad to dorsum before tornus; a line from costa before apex to termen below middle; cilia whitish with bars of fuscous and brown scales except towards tornus. Hindwings with termen scarcely sinuate; pale-grey with obscure darker strigulæ; cilia grey.

Mt. Wellington (2,500 ft.) in January (W. B. Barnard); two specimens.

Tortrix polymicta, n.sp.

πολυμικτος, intricate.

♀. 16 mm. Head ochreous-brown. Palpi 3½; brownish. Antennæ fuscous. Thorax fuscous mixed with ochreous-brown. Abdomen fuscous. Legs fuscous; tarsi annulated with whitish-ochreous; posterior pair whitish-ochreous. Forewings subtriangular, costa slightly bisinuate, apex pointed, termen straight, oblique; white with slight fuscous irroration; markings dark-fuscous; basal patch large, but not developed towards base, its outer margin acutely angled outwards; central fascia and costal triangle confluent, extending on costa from 2/5 to 4/5, its anterior edge nearly straight except in middle where it impinges on a blackish discal spot, its posterior edge acutely angled inwards in middle; two blackish costal dots included in costal triangle; a third dot beyond this, connected with a terminal fascia, dilated in middle, but not reaching tornus; cilia white partly suffused with brownish and with a few dark-fuscous points. Hindwings with termen sinuate; grey with obscure darker strigulations; cilia grey.

Mt. Wellington (2,500 ft.) in January; one specimen.

Tortrix dyschroa, n.sp.

δυσχροος, discoloured.

♂ ♀. 18-20 mm. Head pale reddish-brown. Palpi 2¼; pale reddish-brown. Antennæ grey, towards base pale reddish-brown, ciliations in ♂ 1¼. Thorax reddish-brown sometimes mixed with fuscous. Abdomen grey. Legs fuscous; posterior pair whitish-brown. Forewings suboblong, costa slightly arched, more so near base, apex rounded-rectangular, termen straight, rounded beneath, hardly oblique; in ♂ without costal fold; pale reddish-brown; markings slightly darker, indistinct, sometimes only partly traceable; a moderate basal patch, its outer edge angled outwardly in middle; central fascia from 1/3 costa, moderately broad on costa, dilated but faint or lost towards dorsum; a broad ill-defined terminal suffusion; cilia reddish-brown. Hindwings with termen slightly sinuate; grey; cilia grey.

Cradle Mountain in January; five specimens.

Tortrix tenuifascia, n.sp.

tenuifascius, narrow-banded.

♂. 15-16 mm. Head and thorax reddish-brown. Palpi 2¼; reddish-brown; Antennæ grey; ciliations in ♂ nearly 1.

Abdomen grey. Legs fuscous; posterior pair whitish-brown. Forewings suboblong, rather strongly arched near base, thence straight, apex pointed, termen straight, moderately oblique; in ♂ without costal fold; ochreous-whitish partly suffused and strigulated with reddish-brown; basal patch suffusedly reddish-brown, quite undefined, and succeeded by several fine transverse lines; central fascia distinct, very narrow, almost linear, dark reddish-brown, from 2/5 costa to 2/3 dorsum; costal triangle represented by several more or less confluent spots, from which proceed fine reddish-brown lines or series of strigulæ to tornus and termen; occasionally slight fuscous suffusion on termen and apical part of costa; cilia whitish-brown. Hindwings with termen sinuate; grey; cilia pale-grey with a darker sub-basal line.

Moina (2,000 ft.) and Cradle Mountain (3,000 ft.) in January; five specimens.

Arotrophora castanea, Meyr.

Proc. Linn. Soc. N.S.W., 1910, p. 263.

♂ ♀. 20-23 mm. Head grey-whitish. Palpi 6; grey; upper edge grey-whitish. Antennæ grey; in ♂ thickened, dentate, ciliations ½. Thorax with a small posterior crest; pale-grey, sometimes mixed with reddish-brown, which forms a posterior spot. Abdomen grey. Legs fuscous; tarsi annulated with whitish; posterior pair whitish. Forewings suboblong, costa gently and uniformly arched, apex obtusely pointed, termen straight, oblique; whitish or grey with variable fuscous and reddish-brown suffusion; often a well-defined whitish-brown blotch occupying greater part of costal area from base to middle, reaching costa, or, if not, connected with it at ¼, but this may be wholly absent; a suffused fuscous costal triangle extending from ¼ to apex, usually distinct; some fine blackish dots arranged transversely on end of cell; often a whitish suffusion between this and tornus; often some reddish-brown transverse strigulæ before termen; cilia pale-grey with sub-basal and subapical fuscous lines. Hindwings with termen not or scarcely sinuate; pale-grey with obscure darker strigulæ.

Very variable in the markings of forewing. I have therefore redescribed it, though it appears to agree with Meyrick's species described from a single example with the locality Mount Lofty (?), South Australia.

Lake Fenton (3,500 ft.) in January; ten specimens.

Cnephasia gnophodryas, Low.

♂. 14-16 mm. Head ochreous-brown more or less mixed with fuscous. Palpi 3½; ochreous-brown mixed with fuscous. Antennæ grey, ciliations in ♂ 2. Thorax fuscous usually mixed with reddish-brown. Abdomen fuscous. Legs fuscous; tarsi annulated with ochreous-whitish; posterior pair except tarsi ochreous-whitish. Forewings subtriangular, costa gently arched, apex pointed, termen straight, oblique; in ♂ without costal fold; whitish with numerous wavy transverse fuscous lines more or less mixed with reddish-brown; basal patch moderate, its posterior edge angled outwards in middle; central area sometimes suffusedly whitish, the transverse lines being little developed, occasionally these are partly confluent toward costa and tornus, so as to suggest a central fascia; often a terminal fascia, dilated in middle, not reaching tornus; cilia fuscous, apices whitish, sometimes with whitish bars. Hindwings with termen sinuate; grey; cilia grey.

Variable; in nearly all the Mt. Wellington examples centre of disc is suffusedly whitish, but I did not observe this form in other localities. I think that the ♀ examples from Mt. Wellington, attributed by Mr. Meyrick to *mermera*, Meyr., belong to this species. I have a long series (26 examples) but all of the ♂ sex. It differs from *mermera* (of which I have both sexes) in its smaller size, forewings narrower and without ochreous tinge, longer palpi and antennal ciliations.

Hobart, Mount Wellington (2,500 ft.), Russell Falls, National Park (2,000 ft.), Lake Fenton (3,500 ft.), Wilmot, Moina (2,000 ft.), Cradle Mountain (3,000 ft.), Zeehan, in January and February.

Note.—I sent examples of this as a new species to Mr. Meyrick, who replies—"*Cnephasia gnophodryas*, Low., con-"fused by me hitherto with *tribolana*, which does not occur in "Tasmania; I now admit it is distinct. I have specimens "from Hobart and Mt. Wellington; Lower's was from Hobart. "Quite different from *mermera*, which occurs higher up on "Mt. Wellington, by form of basal patch." On reference to my series, which may be in better condition than Mr. Meyrick's examples, I cannot confirm this last statement, and am still in doubt as to the occurrence of *mermera* in Tasmania.

Cnephasia fractifascia, n.sp.

fractifascius, with broken band.

♀. 15-16 mm. Head whitish-ochreous or whitish. Palpi 3½; whitish-ochreous. Antennæ grey. Thorax fuscous mixed with whitish-ochreous. Abdomen fuscous. Legs fuscous; tarsi annulated with ochreous-whitish; posterior pair ochreous-whitish. Forewings suboblong; costa gently arched, apex pointed, termen straight, oblique; whitish usually partly suffused with pale-ochreous and with some fuscous irroration; markings fuscous-brown; basal patch ill defined, represented by several parallel lines; central fascia represented by a moderate very distinct oblique bar from costa not reaching middle of disc, and a quadrangular tornal spot, the two widely separated; costal triangle small, its apex nearly or quite confluent with that of costal bar; sometimes a straight transverse, subterminal line, usually obsolete or represented by a costal dot only; a narrow, more or less defined, terminal fascia; cilia brownish or fuscous, apices whitish. Hindwings with termen sinuate; pale-grey with obscure darker strigulæ; cilia pale-grey.

Russell Falls, Lake Fenton (3,500 ft.), and Cradle Mountain (3,000 ft.) in January; four specimens.

Cnephasia contortula, n.sp.

contortulus, rather intricate.

♀. 18-21 mm. Head and thorax dark-fuscous with a few whitish scales. Palpi 3; dark-fuscous; base and extreme apex whitish. Antennæ dark-fuscous. Abdomen grey; tuft in ♀ large. Legs fuscous; tarsi annulated with whitish; posterior pair mostly whitish. Forewings suboblong, costa slightly arched near base, thence straight, apex pointed, termen nearly straight, slightly oblique; whitish with dark-fuscous irroration and markings; costa and dorsum strigulated and spotted; basal patch ill defined, partly represented by a median sub-basal spot, angulated outwards; central fascia rather narrow on costa at 1/3 and on tornus, much dilated and suffused in disc, with some tendency to interruption beneath costa; a dot on costa between this and costal triangle, which is small and may contain a central white costal dot; a costal dot beyond this; a rather irregular triangular terminal blotch; cilia whitish barred with fuscous and with a dark-fuscous sub-basal line. Hindwings with termen sinuate; pale-grey with darker strigulæ; cilia pale-grey with a darker sub-basal line.

Probably nearest *C. argyrocosma*, Turn.

Wilmot in February (W. B. Barnard); four specimens.

Fam. EUCOSMIDÆ.

Spilonota hypomolybda, n.sp.

ὑπομολυβδος, leaden beneath.

♂. 22-23 mm. Head and thorax fuscous. Palpi grey-whitish, outer surface fuscous except base and sub-basal and subapical bands on second joint. Antennæ fuscous; notch in ♂ at 1/5. Abdomen grey. Legs fuscous. Forewings moderate, costa gently arched, apex rounded-rectangular, dorsum slightly oblique; costal fold in ♂ narrow, extending to about middle; fuscous with obscure grey strigulæ and suffusion; numerous fine grey costal strigulæ; an ill-defined grey dorsal suffusion, broadening in middle to extend half across disc, extending to about $\frac{3}{4}$ dorsum, in one example scarcely indicated; cilia grey with whitish points and an incomplete interrupted fuscous line before middle. Hindwings broad, termen rounded; 3 and 4 stalked; leaden-grey; cilia grey with a sub-basal fuscous line not extending to tornus. Underside of both wings wholly suffused with leaden-grey except for a terminal fuscous band on forewings.

Although otherwise obscure and variable, this species may be recognised by the leaden-grey suffusion of hindwings and underside. Probably this is a secondary sexual character.

Launceston in September; two specimens in the Littler Collection bearing not only a printed locality label but the exact date of capture (25-IX-13). Type in South Australian Museum.

Spilonota argyrotypa, n.sp.

ἀργυροτυπος, silver-marked.

♂. 12 mm. Head, thorax, and abdomen fuscous. Palpi 3; grey. Antennæ fuscous; in ♂ with notch at 1/5, ciliations imperceptible. Legs fuscous. Forewings narrow, not dilated, costa slightly arched, apex subrectangular, termen straight, very slightly oblique; costal fold in ♂ moderate, reaching 1/3, dark ochreous-brown becoming fuscous towards base; three incomplete silvery transverse fasciæ, first from beneath 1/3 costa to mid-dorsum; second above tornus not reaching margins; third from 4/5 costa to termen above tornus; third fascia preceded and followed by a silvery costal dot; cilia silvery-grey, on apex fuscous. Hindwings with termen not sinuate; 3 and 4 stalked; grey; cilia grey.

Cradle Mountain (3,000 ft.) in January; one specimen.

Fam. ELACHISTIDÆ.

Elachista diatoma, n.sp.

διατομος, cut through.

♂. 11 mm. Head and thorax fuscous with brassy reflections and a few whitish scales. Palpi and antennæ fuscous. Abdomen dark-fuscous; tuft grey-whitish. Legs fuscous. Forewings narrow, costa gently arched, apex pointed, termen extremely oblique; fuscous with brassy reflections; a moderately broad white median streak from base to apex; cilia grey, mixed with whitish around apex. Hindwings lanceolate; grey; cilia 4, grey.

Cradle Mountain (3,000 ft.) in January; one specimen.

Coleophora deauratella, Zel.

Meyr. Brit. Lep. p. 646.

♂ ♀. 13-16 mm. Head and thorax brassy-green. Palpi, antennæ, abdomen, and legs fuscous. Forewings lanceolate; brilliant brassy-green, towards apex often brassy-red; cilia brassy-red or brassy-green around apex, on termen and tornus fuscous. Hindwings lanceolate; grey; cilia 5, grey.

A brilliant species quite unlike anything else found in Tasmania. It is now probably found commonly all over the island, and I have received it also from Gisborne, Victoria. Mr. Meyrick kindly identified it for me as without doubt this species, and without doubt also introduced. In his work on British Lepidoptera it is stated that the larva is found on flowerheads of *Trifolium*, living in a case made of part of a floret.

The species could not have been present, or at least not established, in Tasmania when Meyrick collected there in 1882-3, and we have no record of its occurrence before 1925. My Gisborne example is dated 1923. Probably the species was accidentally imported in fodder.

Fam. GELECHIADÆ.

Epiphthora acrocola, n.sp.

ἀκροκολος, shortened at the apex.

♀. 17 mm. Head and thorax whitish-brown. Palpi with second joint long, terminal joint very short (about 1/4); whitish-brown. Antennæ whitish-brown. Abdomen and legs grey. Forewings elongate, costa rather strongly

arched, apex rather obtuse; whitish, finely and fairly uniformly irrorated with grey-brown; cilia brown-whitish with some fuscous irroration opposite apex. Hindwings with emargination rounded-rectangular, apical projection about 1/5; grey; cilia 3, grey.

This species should be recognisable by the very short terminal joint of palpi.

Wilmot in January, one specimen.

Epiphthora hyperænicta, n.sp.

ὑπεραινικτος, very obscure.

♂. 12 mm. Head, antennæ, thorax, abdomen, and legs fuscous. Palpi with second joint moderate, with a small apical inferior tuft, terminal joint about ½; fuscous. Forewings narrow, costa gently arched, apex rounded; pale-grey with fine fuscous irroration; cilia concolorous, on dorsum grey. Hindwings with emargination slight, rectangular, apical projection about 1/5; grey; cilia 3½, grey.

Strahan in February; one specimen.

Aristotelia bacillum, n.sp.

bacillum, a little stick.

♂ ♀. 14-16 mm. Head and thorax fuscous-whitish, more or less pinkish-tinged. Palpi with second joint rough beneath, broadly expanded at apex with rough scales especially above; terminal joint shorter, slender, acute; fuscous; second joint with apical, terminal joint with basal and median whitish rings. Antennæ fuscous. Abdomen grey. Legs fuscous; posterior pair grey-whitish with fuscous tarsal rings. Forewings elongate-oval, costa gently arched, apex rounded; 6 separate; whitish more or less tinged with pink and irrorated with fuscous; sometimes a broad whitish costal streak throughout, and a fuscous median streak, well-defined on costal edge, suffused towards dorsum; in other examples the costal streak may be more or less obliterated by fuscous irroration, and the median streak scarcely developed; stigmata fuscous, not always distinct, first at ¼ above middle, second on fold beyond first, third in middle of disc towards costa, sometimes a fourth beneath and slightly beyond first; cilia pinkish-grey with blackish irroration on bases, and a blackish apical streak or hook. Hindwings with apex acute, termen strongly sinuate; pale-grey; cilia 1½, pale-grey.

Strahan in February; eight specimens.

Protolechia chionoprora, n.sp.

χιονοπρωρος, with snow-white prow.

♂. 20 mm. Head white. Palpi smooth-scaled; terminal joint longer than second, nearly as stout as second throughout, acute at apex; white, extreme base of second joint fuscous. Antennæ grey, towards base whitish, basal joint white. Thorax white with lateral longitudinal blackish stripes. Abdomen pale-grey, tuft and underside ochreous-whitish. Legs ochreous-whitish; anterior and middle tibiæ and tarsi with fuscous rings. Forewings elongate, costa nearly straight except near base and apex, apex obtusely pointed, termen very oblique; 2 and 3 stalked; whitish-brown partly suffused with fuscous-brown; four oblique dark-fuscous streaks from costa; first at base, very short; second sub-basal; third from 1/3; fourth from middle, prolonged subcostally by a very fine dark-fuscous line to apex; a fine blackish line along fold to middle, with some fuscous suffusion on its dorsal side; a short longitudinal blackish discal streak beyond middle; a subterminal blackish line; cilia ochreous-whitish, bases ochreous-grey. Hindwings with termen sinuate; grey; cilia grey-whitish.

One of the *aversella* group, but immediately distinguished by the peculiar palpi, which may however be found only in the ♂.

Rosebery in February; one specimen (W. B. Barnard).

Protolechia crypsicneca, n.sp.

κρυψικνηκος, with hidden yellow.

♀. 20 mm. Head, thorax, and abdomen fuscous. Palpi fuscous; second joint with white irroration especially on internal surface. Antennæ fuscous. Legs fuscous; tibiæ and tarsi with whitish rings. Forewings narrow, constricted posteriorly, costa moderately arched, apex pointed, termen very oblique; 2 and 3 stalked; fuscous; two white but fuscous-irrorated fasciæ; first from ¼ costa, slightly outwardly oblique, moderately broad, ending abruptly just across fold; second from ¾ costa, broad on costa, narrowing towards tornus, indented near middle posteriorly, its outer edge suffused with pale yellowish; discal dots dark fuscous, first at 1/3 on posterior edge of first fascia, second before 2/3 on anterior edge of second fascia, plical on posterior edge of first fascia slightly beyond first discal; cilia fuscous mixed with whitish, towards tornus grey. Hindwings with termen sinuate; grey; cilia grey.

Cradle Mountain (3,000 ft.) in January; one specimen (W. B. Barnard).

Fam. XYLORYCTIDÆ.

Maroga unipunctana, Don.

Race *tasmanica*. This differs from the typical form in its smaller size (♂ 37 mm., ♀ 54-56 mm.), larger spot on forewings, and fuscous hindwings in both sexes. I do not think it can be regarded as more than a local race.

Fam. ŒCOPHORIDÆ.

Borkhausenia acalles, n.sp.

ἀκαλλης, without charms.

♂. 20 mm. Head, thorax, and abdomen fuscous. Palpi ochreous-whitish irrorated with fuscous. Antennæ fuscous; ciliations in ♂ 1. Legs fuscous; tarsi with ochreous-whitish rings; posterior pair paler. Forewings moderate, posteriorly dilated, costa gently arched, apex rounded, termen obliquely rounded; whitish-ochreous irrorated and suffused with fuscous; markings fuscous; a narrow basal fascia; a discal dot at ⅓, a second in middle, plical before first discal; second discal followed by a pale dot; a very suffused broad fascia from 2/3 costa to tornus; a sinuate subterminal fascia, from 5/6 costa to termen above tornus, broadest beneath costa; a terminal series of dots; cilia whitish-ochreous barred with fuscous. Hindwings and cilia pale grey.

Mount Wellington (2,500 ft.) in January; one specimen (W. B. Barnard).

Leptocroca eucentra, n.sp.

εὐκεντρος, well-pointed.

♂. 18-24 mm. Head white or grey-whitish. Palpi white; external surface of second joint dark fuscous. Antennæ dark grey; ciliations of ♂ very long (6). Thorax white; anterior edge dark fuscous. Abdomen grey; tuft whitish. Legs fuscous; tarsi with fine whitish annulations; posterior pair whitish. Forewings elongate, narrow, costa gently arched, apex acute, termen very oblique; whitish with patchy fuscous suffusion; discal dots blackish; first at ⅓; second beyond middle; plical much before first discal, connected with dorsum by a fuscous suffusion, which sometimes forms an elongate triangular blotch; apical portion of disc more fuscous-suffused; a row of submarginal fuscous dots along apical half of costa and termen to tornus; cilia whitish with an obscure, whitish, interrupted, sub-basal line. Hindwings elongate-ovate; pale-grey; cilia grey-whitish.

Mount Wellington (2,500 ft.), Russell Falls, Lake Fenton (3,500 ft.), Moina (2,000 ft.), and Cradle Mountain (3,000 ft.) in January; abundant in the last-named locality, but I saw only the one sex.

Leptocroca silicolor, n.sp.

silicolor, ochreous.

♂. 23-25 mm. Head whitish-ochreous. Palpi whitish-ochreous irrorated with fuscous. Antennæ fuscous; ciliations in ♂ 1½. Thorax fuscous; apex and apices of shoulder-flaps whitish-ochreous. Abdomen pale-grey; tuft whitish-ochreous. Legs fuscous; tibiæ and tarsi annulated with whitish-ochreous; posterior pair mostly whitish-ochreous. Forewings strongly dilated, costa moderately arched, apex rounded, termen obliquely rounded; whitish-ochreous irrorated with fuscous; a large fuscous spot on base of costa not reaching dorsum; a suffused fuscous blotch on dorsum before middle; discal dots fuscous, minute, and followed by small whitish-ochreous dots; first at ⅓, second in middle, plical before first discal; apical part of disc suffused with fuscous; cilia whitish-ochreous, bases irrorated with fuscous. Hindwings broadly ovate; grey; cilia grey.

Mount Wellington (2,500 ft.) in January; two specimens.

Locheutis dolichotricha, n.sp.

δολιχοτριχος, long-haired.

♂. 20 mm. Head whitish-ochreous; face pale fuscous. Palpi fuscous; apex of second joint and a subapical ring on terminal joint whitish-ochreous. Antennæ grey; in ♂ with fascicles of extremely long cilia (10). Thorax brownish-ochreous. Abdomen pale grey. Legs fuscous; tibiæ and tarsi annulated with whitish-ochreous, posterior pair except tarsi whitish-ochreous. Forewings elongate, slightly dilated posteriorly, costa nearly straight, apex round-pointed, termen very obliquely rounded; whitish-ochreous irrorated with fuscous; a dark fuscous dot on base of costa; discal dots dark-fuscous; first at 1/3, second at 2/3, plical beyond first discal; a pale line due to absence of irroration between first and second discal; a terminal series of dark fuscous dots; cilia whitish-ochreous with a few fuscous scales, apices paler. Hindwings and cilia whitish.

Mount Wellington (2,500 ft.) in January; one specimen.

Locheutis inconcinna, n.sp.

inconcinnus, inelegant.

♂. 21 mm. Head and thorax ochreous-whitish mixed with fuscous. Palpi fuscous irrorated with ochreous-whitish, apices of second and terminal joints ochreous-whitish. Antennæ fuscous; ciliations in ♂ 4. Legs fuscous; tarsal rings and posterior pair ochreous-whitish. Forewings narrow, not dilated, costa slightly arched, apex round-pointed, termen very obliquely rounded; ochreous-whitish irrorated throughout with fuscous; markings fuscous; a discal dot at 1/3, a second rather elongate at 2/3, with a whitish dot beneath it, plical beneath first discal; suffused costal spots at 2/3, and before apex, the latter giving rise to an indistinct subterminal line, cilia ochreous-whitish, bases barred with fuscous. Hindwings pale grey; cilia grey-whitish.

Mount Wellington (2,500 ft.) in January; one specimen (W. B. Barnard).

Œnochroa thermistis, Low.

I am not sure that this is more than a form of *O. lætella*, Wlk.

Œnochroa phœnochytà, n.sp.

φοινοχυτος, suffused with red.

♂. 30-32 mm. Head pale red. Palpi pale red; second joint irrorated with dark fuscous externally; terminal joint dark fuscous except apex. Antennæ whitish-ochreous annulated with fuscous, apex of basal joint pale red; ciliations of ♂ 1. Thorax with a large posterior crest; reddish partly fuscous-suffused. Abdomen grey; tuft reddish. Legs dark fuscous; tibiæ and tarsi annulated with pale reddish. Forewings broad, oval-triangular, costa moderately arched, apex rounded, termen obliquely rounded; pale red irrorated with fuscous, which in posterior part of disc tends to form streaks on veins; a blackish dot on base of costa; a suffused, interrupted, fuscous streak on fold; a fine, blackish, longitudinal, median streak from ¼ to middle, succeeded by a blackish spot, from which it is separated by a small reddish or reddish-white spot; a similar spot separates the latter from a short blackish streak running into subterminal line; a curved fuscous subterminal line from 4/5 costa to tornus; cilia pale red mixed with fuscous. Hindwings pale grey; cilia pale grey, on apex reddish-tinged.

The reddish colouring is assimilated to that of the trunks of tree-ferns.

Russell Falls and Moina (2,000 ft.) in January; six specimens.

Trachypepla glebifera, n.sp.

glebiferus, lumpy.

♂. 22 mm. Head and thorax whitish-grey. Palpi ochreous-whitish irrorated with dark fuscous; terminal joint with a dark fuscous subapical ring. Antennæ grey. Abdomen grey-whitish; bases of segments ochreous-grey on dorsum. Legs fuscous; posterior pair mostly ochreous-whitish. Forewings moderate, not dilated, costa gently arched, apex round-pointed, termen obliquely rounded; whitish with patchy fuscous suffusion; large subdorsal transverse crests at ¼ and ¾, pale fuscous; a dark fuscous streak from 1/3 costa to first crest, surrounded by dark fuscous suffusion; uneven dark fuscous suffusion between second crest, termen, and apex, tending to form an interrupted subterminal line and apical spot; cilia fuscous-whitish with dark fuscous points. Hindwings grey; cilia whitish-grey.

Bothwell in February; one specimen (W. B. Barnard).

Gen. ORESCOA, nov.

ὀρεσκοος, lurking in the mountains.

Head smooth. Tongue present. Labial palpi rather short, second joint not reaching base of antennæ, terminal joint ¼. Antennæ with pecten not strongly developed, in ♂ moderately ciliated. Thorax smooth. Forewings with 2 and 3 stalked, 7 to apex. Hindwings ovate-lanceolate; neuration normal.

Near *Elæonoma*, Meyr.; differing in the short terminal joint of palpi and form of hindwings.

Orescoa homoconia, n.sp.

ὁμοκονιος, uniformly dusty.

♂ ♀. 18-20 mm. Head pale ochreous. Palpi whitish-ochreous; external surface of second joint except apex fuscous. Antennæ grey; ciliations in ♂ 1. Thorax pale grey. Abdomen grey. Legs fuscous. Forewings narrow, strongly dilated posteriorly, costa gently arched, apex round-pointed, termen very oblique; grey densely and uniformly irrorated with whitish-grey; discal dots fuscous, first discal at ⅓, second at about middle, plical before first discal, but the two basal dots may be obsolete; cilia whitish-grey. Hindwings grey; cilia whitish-grey.

Mount Wellington (2,500 ft.), Lake Fenton (3,500 ft.), and Cradle Mountain (3,000 ft.) in January; five specimens.

Barea heterophanes, n.sp.

ἑτεροφανης, of different appearance.

♂ ♀. 22-24 mm. Head whitish; side tufts sometimes fuscous-tinged. Palpi whitish; second joint partly fuscous on outer surface except at apex; terminal joint fuscous at base and apex. Antennæ fuscous; ciliations in ♂ 1. Thorax fuscous; tuft whitish posteriorly. Abdomen grey, sometimes ochreous-tinged. Legs dark-fuscous; tibiæ and tarsi white-ringed; posterior pair except tarsi whitish. Forewings triangular, costa rather strongly arched, apex pointed, termen slightly rounded, oblique; fuscous; some whitish irroration towards margins; discal spots dark-fuscous finely edged with whitish; a dot in disc at 1/3, a larger spot before 2/3, a dot midway between these, an elongate oblique subdorsal mark beneath first, a fifth dot beneath third; a suffused whitish costal spot at ¾, giving rise to a fine outwardly curved whitish line to tornus; a dark fuscous spot on costa between whitish spot and apex; cilia fuscous mixed with whitish. Hindwings and cilia pale-grey.

Mt. Wellington, Russell Falls in January, Rosebery, Zeehan, and Strahan in February; five specimens.

Barea hypselotropha, n.sp.

ὑψηλοτροφος, bred on the heights.

♂. 15-18 mm. Head fuscous. Palpi fuscous; apex of second joint white. Antennæ fuscous; ciliations in ♂ 3. Thorax fuscous with some white scales posteriorly. Abdomen fuscous; under-surface mixed with white. Legs fuscous; tarsi with whitish rings. Forewings rather narrow, not dilated, costa moderately arched, apex rounded, termen obliquely rounded; white with dark fuscous irroration and markings; a short streak from base of costa on fold; a fascia from 1/3 costa to mid-dorsum, sometimes interrupted beyond middle; a second fascia from before 2/3 costa to tornus, interrupted in middle; first discal and plical just beyond first fascia; second discal confluent with upper half of second fascia just above interruption; a white dot just beneath; a subapical blotch with an inwardly projecting tooth in middle; cilia fuscous with a few white scales. Hindwings dark grey; cilia grey.

Cradle Mountain (3,000 ft.) in January; three specimens (W. B. Barnard).

Eulechria ductaria, Meyr.

This is a mountain species. We took a series at Lake Fenton and Cradle Mountain. The locality of the type is given as Hobart, but probably it was taken on Mount Wellington.

Eulechria anomophanes, n.sp.

ἀνομοφανης, of unusual appearance.

♂. 20-22 mm. Head, palpi, and thorax whitish-grey. Antennæ whitish-grey; ciliations in ♂ 1. Abdomen whitish-grey. Legs fuscous; tarsi with whitish annulations; posterior pair whitish. Forewings scarcely dilated, costa gently arched, apex rounded, termen obliquely rounded; white; a rather large, pale grey, basal patch, angled outwards on fold; a broad pale-grey fascia extending on costa from 1/5 to 2/5, on dorsum from ¼ to ¾; a dark fuscous, transverse, short, discal mark at 3/5 interruptedly connected by a short line with tornus; a suffused dark fuscous spot on costa at 2/3, connected by an outwardly curved line with tornus; most of the area between these fuscous markings is occupied by a reddish-brown blotch, which extends over a large area beyond, but is there more greyish; a terminal series of dark fuscous dots; cilia fuscous, bases and apices partly whitish.

Mount Wellington (2,500 ft.) in January; five specimens.

Eulechria sciaphila, n.sp.

σκιαφιλος, shade-loving.

♂. 25-28 mm. Head, palpi, and thorax fuscous with a few whitish scales. Antennæ fuscous; ciliations in ♂ 1½. Abdomen fuscous. Legs fuscous; posterior tibiæ grey-whitish. Forewings elongate, not dilated, costa gently arched near base, thence straight, apex rounded, termen very obliquely rounded; fuscous uniformly irrorated with whitish; discal dots fuscous, first at ¼, second beyond middle, plical beneath first discal; cilia fuscous with a few whitish scales. Hindwings and cilia grey.

Lake Fenton (3,500 ft.) in January; two specimens (W. B. Barnard).

Eulechria oxypeuces, n.sp.

ὀξυπευκης, sharp-pointed.

♂. 24 mm. Head white; side-tufts mixed with grey. Palpi fuscous; apex of second joint white. Antennæ grey, towards base whitish; ciliations of ♂ 2½. Thorax white irrorated with grey. Abdomen grey-whitish; on dorsum barred with brownish-ochreous. Legs fuscous; [posterior pair missing]. Forewings narrowly elongate, costa gently arched, apex acute, termen extremely oblique; white partly suffused with pale grey; discal dots large, grey, first discal and plical confluent forming a large, elongate, inwardly oblique spot from beneath 1/3 costa, crossing fold; second

discal beneath 2/3 costa, with a suffused spot between it and lower part of termen; a broad grey suffusion along costa from 1/3 to apex; a terminal series of grey dots; cilia pale grey. Hindwings and cilia pale grey.

Bothwell in February; one specimen (W. B. Barnard).

Eulechria sthenopis, n.sp.

σθενωπις, strongly built.

♂. 26-28 mm. Head whitish. Palpi fuscous; apex of second and base of terminal joint whitish. Antennæ grey; ciliations in ♂ 2/3. Thorax whitish irrorated with fuscous. Abdomen grey. Legs fuscous; tarsal rings and posterior pair ochreous-whitish. Forewings rather broad, slightly dilated posteriorly, costa gently arched, apex rounded, termen obliquely rounded; whitish with some fuscous irroration; markings fuscous; a basal costal spot sometimes extending to dorsum; a broad, outwardly oblique bar from 1/5 costa, gradually narrowing to its apex on fold; a discal dot at 1/3, another beneath it on fold, a third above middle, and three arranged in a transverse crescent at 2/3; rarely a slight ochreous suffusion around plical and posterior discal dots; a rather large, triangular, suffused spot on mid-costa; another at ¾, from which proceeds a subterminal line, strongly curved outwards, ending on tornus; a terminal series of interneural dots, sometimes prolonged into disc as short streaks; cilia grey, bases fuscous barred with whitish. Hindwings pale grey; cilia whitish with a pale grey basal line.

Cradle Mountain (3,000 ft.) in January; ten specimens all of the one sex.

Eulechria cirrhopis, n.sp.

κιρρωπις, yellowish.

♀. 18 mm. Head and thorax pale ochreous. Palpi short, second joint not reaching base of antennæ, terminal joint ½; pale ochreous. Antennæ pale ochreous with blackish annulations. Abdomen grey; barred on dorsum with brownish-ochreous. Legs pale ochreous; anterior and middle tibiæ and tarsi fuscous except on apices of segments. Forewings moderate, not dilated, costa slightly arched, apex round-pointed, termen very oblique; pale ochreous with a few scattered fuscous scales; discal dots dark fuscous, first at 2/5, second at 3/5, plical before first discal; cilia pale ochreous. Hindwings pale grey; cilia ochreous-whitish with a pale grey sub-basal line.

Russell Falls in January; two specimens.

Eulechria tacita, n.sp.

tacitus, quiet.

♂ ♀. 13-14 mm. Head and palpi fuscous with slight whitish irroration. Antennæ fuscous; ciliations in ♂ 2½. Thorax, abdomen, and legs fuscous. Forewings narrow, not dilated, costa slightly arched, apex round-pointed, termen nearly straight, oblique; fuscous irrorated with whitish, especially in central part of disc; discal dots dark fuscous, first beyond 1/3, second at 2/3, plical well before first discal; cilia fuscous, apices paler. Hindwings and cilia fuscous.

Zeehan and Strahan in February; two specimens.

Eulechria psathyropa, n.sp.

ψαθυρωπος, of fragile appearance.

♀. 19 mm. Head and palpi pale fuscous-brown. Antennæ and thorax fuscous. Abdomen fuscous; on dorsal broadly brown behind middle. Legs fuscous; tarsal rings and most of posterior tibiæ ochreous-whitish. Forewings narrow, strongly dilated posteriorly, costa gently arched, apex round-pointed, termen nearly straight, oblique; whitish with general fuscous irroration, but less in central part of disc; markings fuscous; first discal at 1/3, second before 2/3, a third between and above these, plical before first discal; a costal spot at 5/6 giving rise to a strongly outwardly curved line to tornus; cilia whitish, on apex fuscous. Hindwings and cilia pale grey.

Cradle Mountain (3,000 ft.) in January; one specimen.

Tisobarica phæopyra, n.sp.

φαιοπυρος, dark, but fiery.

♂. 14 mm. Head and thorax brassy-fuscous. Palpi rather short, second joint not reaching base of antennæ, terminal joint ½; fuscous. Antennæ dark fuscous; ciliations in ♂ extremely long (8). Abdomen and legs dark fuscous. Forewings narrow-oblong, costa straight; apex round-pointed, termen straight, moderately oblique; fuscous; markings dark fuscous with brassy and purple-metallic reflections; a basal patch; a costal streak to 2/3; a broad oblique fascia from 1/3 costa ending in a rounded apex before reaching mid-dorsum; a circular blotch in disc at 2/3, confluent with costal streak; a terminal suffusion; a clear yellow elongate dot on fold; cilia fuscous. Hindwings and cilia fuscous.

Differs from others of the genus by its shorter palpi, longer antennal ciliations, and general *facies*, but it seems best to refer it here.

Mount Wellington (2,500 ft.) in January; one specimen.

Machimia pastea, n.sp.

παστεος, besprinkled.

♂. 22 mm. ♀. 27 mm. Head, palpi, and thorax pale ochreous-grey in ♂, purplish-grey in ♀. Antennæ grey; ciliations in ♂ 1. Abdomen pale grey, in ♀ with a large brownish-ochreous spot on dorsum of each segment. Legs ochreous-whitish; anterior pair fuscous; anterior tarsi with ochreous-whitish annulations. Forewings dilated posteriorly, costa moderately arched, apex rounded in ♂, round-pointed in ♀, termen obliquely rounded; 7 to apex; pale ochreous-grey in ♂, purplish-grey in ♀, with scanty blackish irroration; markings blackish; a discal dot at 1/3, a second before 2/3, plical slightly beyond first discal; a submarginal series of dots along apical third of costa and whole of termen; cilia concolorous. Hindwings whitish with a few fuscous scales towards termen; cilia whitish.

Russell Falls in January; two specimens.

Machimia brachytricha, n.sp.

βραχυτριχος, short-haired.

♂. 32-34 mm. Head and thorax pale rosy. Palpi whitish tinged with rosy; terminal joint partly fuscous anteriorly. Antennæ grey, towards base rosy annulated with grey; ciliations in ♂ extremely short (½). Abdomen brownish-grey. Legs ochreous-whitish; anterior pair rosy. Forewings suboblong, only slightly dilated, costa strongly arched, apex subrectangular, termen slightly oblique, rounded beneath; 7 to termen; rosy; markings fuscous; a discal dot beyond ⅓, a second beyond middle, plical slightly beyond first discal; a very fine, sometimes obsolete, line from beneath midcosta obliquely outwards to ⅔, there bent at a right angle, and curved to dorsum slightly before tornus; sometimes a terminal series of dots; cilia rosy. Hindwings whitish; towards apex and termen suffused with grey; cilia grey whitish.

Easily recognised by the extremely short antennal ciliations, but otherwise a perfectly normal species of the genus.

Lake Fenton (3,500 ft.) and Cradle Mountain (3,000 ft.) in January; eight specimens.

Euprionocera hypertricha, n.sp.

ὑπερτριχος, extremely hairy.

♂. 25 mm. Head ochreous-grey. Palpi grey; inner surface ochreous-whitish. Antennæ fuscous; ciliations in ♂ extremely long (10). Thorax ochreous-grey. Abdomen grey. Legs ochreous; anterior pair and middle femora

fuscous. Forewings suboblong, costa strongly arched to middle, thence straight, apex rectangular, termen straight, not oblique, but obliquely rounded towards tornus; grey suffused and irrorated with ochreous; five ochreous-whitish small costal spots from ½ to near apex, each followed by a fuscous dot; cilia ochreous mixed with grey, apices whitish. Hindwings broader than forewings; whitish; apical third, terminal, and dorsal margins dark grey; cilia whitish, bases dark grey.

Mount Wellington (3,500 ft.) in January; one specimen.

Ocystola polyphila, n.sp.

πολυφιλος, much esteemed.

♀. 21 mm. Head brown. Palpi whitish with fuscous irroration; terminal joint fuscous. Antennæ fuscous. Thorax fuscous-brown; shoulder-flaps yellow. [Abdomen missing.] Legs whitish irrorated with fuscous. Forewings elongate, not dilated, costa gently arched, apex round-pointed, termen nearly straight, oblique; rather deep yellow; costal edge rosy as far as middle; a rather large, triangular, fuscous spot on dorsum from middle to tornus; cilia yellow, rosy-tinged, on tornus narrowly fuscous. Hindwings grey; cilia pale grey.

Cradle Mountain (3,000 ft.) in January; one specimen.

Cœsyra plectanora, n.sp.

πλεκτανορος, wearing a wreath.

♀. 22 mm. Head whitish. Palpi whitish with slight fuscous irroration. Antennæ and thorax fuscous. Abdomen brownish-fuscous. Legs fuscous; posterior pair grey, whitish on dorsum. Forewings moderate, slightly dilated, costa gently arched, apex pointed, termen nearly straight, strongly oblique; fuscous with white markings; a strongly curved, semicircular fascia from near base of costa to 1/5 dorsum; an inwardly oblique fascia from 2/3 costa towards ¾ dorsum, constricted above middle, not reaching dorsum; a narrow fascia from 5/6 costa to termen below middle, angled inwards beneath costa; cilia fuscous. Hindwings and cilia grey.

Mount Wellington (2,500 ft.) in January; one specimen (W. B. Barnard).

Cœsyra ochrocirrha, n.sp.

ὠχροκιρρος, pale yellowish.

♂ ♀. 19-20 mm. Head and thorax pale yellowish. Palpi pale yellowish; second joint partly dark fuscous ex-

ternally. Antennæ grey; ciliations in ♂ 3. Legs fuscous; tibiæ and tarsi annulated with whitish-ochreous; posterior pair mostly whitish-ochreous. Forewings suboval, dilated somewhat posteriorly, costa moderately arched, apex round-pointed, termen very obliquely rounded; pale yellowish, sometimes with some grey suffusion; discal dots grey, first at 1/3, second before 2/3, plical before first discal; cilia pale yellowish, sometimes partly grey. Hindwings and cilia pale grey.

Cradle Mountain (3,000 ft.) in January; seven specimens.

Pleurota chlorochyta, Meyr.

I think *P. perisema*, Low., is a synonym of this species.

Pleurota tritosticta, n.sp.

τριτοστικτος, three-spotted.

♂. 20-25 mm. Head, palpi, thorax, abdomen, and legs fuscous. Antennæ fuscous; ciliations in ♂ 1. Forewings elongate, scarcely dilated, costa gently arched, apex pointed, termen nearly straight, strongly oblique; fuscous; discal dots blackish, very distinct, first at 1/3, second before 2/3, third on fold before first, elongate; cilia fuscous. Hindwings and cilia pale grey.

Larger than *P. psephena*, from which it is readily distinguished by the plical dot being considerably before first discal.

Lake Fenton (3,500 ft.) in January; three specimens.

Pleurota titanitis, n.sp.

τιτανιτις, chalky.

♀. 22 mm. Head and thorax whitish. Palpi whitish; external surface of second and terminal joints fuscous except at base and apex. Antennæ and abdomen grey. Legs fuscous; posterior pair whitish. Forewings rather narrow, not dilated, costa gently arched, apex pointed, termen very oblique; whitish with some grey irroration towards margins; a rather broad, even, grey, dorsal streak throughout; discal dots blackish, first at 1/3, second before 2/3, plical elongate, well before first discal; a suffused fuscous apical spot; cilia whitish. Hindwings grey-whitish; cilia whitish.

Cradle Mountain (3,000 ft.) in January; one specimen (W. B. Barnard).

Atheropla fumosa, n.sp.

fumosus, smoky.

♂. 15-18 mm. Head fuscous; side-tufts ochreous. Palpi ochreous; outer surface of second joint, except apex, and

apex of terminal joint dark fuscous. Antennæ fuscous, basal joint ochreous; ciliations in ♂ 6. Thorax dark fuscous; anterior margin and shoulder-flaps ochreous. Legs dark fuscous; anterior and middle tarsi mostly ochreous; posterior tibiæ and tarsi grey. Forewings rather narrow, slightly dilated posteriorly, costa very slightly arched, apex pointed, termen slightly rounded, strongly oblique; fuscous; a broad ochreous costal streak gradually narrowing to 5/6; discal dots rather large, dark fuscous, first at ¼, second about middle, plical beneath first discal, the latter two each followed by an ochreous dot; three or four ochreous terminal dots; cilia fuscous. Hindwings and cilia fuscous.

Mount Wellington (3,500 ft.) and Lake Fenton (3,500 ft.) in January; nine specimens.

Enchronista bathrosticha, n.sp.

βαθροστιχος, with basal line.

♂ ♀. 25-28 mm. Head ochreous-whitish. Palpi ochreous-whitish; second joint fuscous at base, and slightly so before apex. Antennæ grey, near base fuscous; ciliations in ♂ 3. Thorax ochreous-whitish, sometimes fuscous anteriorly. Abdomen pale grey. Legs fuscous; tibiæ and tarsi with ochreous-whitish annulations; posterior pair ochreous-whitish. Forewings dilated posteriorly, costa rather strongly arched, apex pointed, termen nearly straight. oblique; ochreous-whitish with dark fuscous markings and scanty irroration; a conspicuous line from base of costa along fold to 1/5; a discal dot at ¼, another at ½, two smaller dots transversely placed between these; suffused costal spots at 2/3 and before apex, sometimes suffusedly produced into disc; a terminal series of dots; cilia ochreous-whitish. Hindwings and cilia grey-whitish.

Not unlike some species of *Chezala*, but I find no trace of an antennal pecten.

Russell Falls and Cradle Mountain (3,000 ft.) in January; three specimens.

Chezala liopa, n.sp.

λειωπος, smooth.

♂. 24 mm. Head and thorax whitish-ochreous. Palpi whitish-ochreous; base of second joint fuscous. Antennæ grey; ciliations in ♂ 1½. Abdomen ochreous-whitish. Legs fuscous; tibiæ and tarsi with whitish-ochreous rings; posterior pair mostly whitish-ochreous. Forewings whitish-ochreous with a few fuscous scales; markings fuscous; costal edge fuscous to about middle; a basal costal dot; first discal

at ¼, second larger and transversely elongate beyond middle, an additional dot above and between these, plical slightly before first discal; cilia whitish-ochreous. Hindwings grey-whitish; cilia whitish.

Cradle Mountain (3,000 ft.) in January; one specimen (W. B. Barnard).

Gen. ORESITROPHA, nov.

ὀρεσιτροφος, mountain-bred.

Palpi very long; second joint more than twice length of face; terminal joint ½, rather stout. Antennæ with pecten weakly developed; in ♂ with moderate ciliations. Forewings with 2 from 4/5, 3 from shortly before angle, 7 to termen, 11 from middle of cell. Hindwings normal.

Differs from *Tanyzancla*, Meyr., in the shorter and stouter terminal joint of palpi, from *Delonoma*, Meyr., in 3 and 4 of forewings being well separate.

Oresitropha melanotypa, n.sp.

μελανοτυπος, black-marked.

♂. 24 mm. Head pale ochreous. Palpi pale ochreous; bases of second and terminal joints and some irroration dark fuscous. Antennæ pale ochreous annulated with blackish; ciliations in ♂ 1. Thorax pale ochreous; shoulder flaps fuscous. Abdomen grey. Legs fuscous; tibiæ and tarsi ringed with pale ochreous; posterior pair mostly pale ochreous. Forewings elongate, narrow, strongly dilated posteriorly, costa slightly arched, apex rounded, termen very obliquely rounded; pale ochreous with scanty blackish irroration, especially towards costa; markings blackish; a broad, irregularly outlined, median bar from 1/5 to middle, slightly expanded at anterior end, deflected towards costa posteriorly, and giving off two or three fine streaks along veins; a large costal spot at 5/6 from which proceeds a sinuate line to tornus; cilia whitish-ochreous. Hindwings grey; cilia whitish, bases grey.

Cradle Mountain (3,000 ft.) in January; one specimen (W. B. Barnard).

Philobota phœnopasta, n.sp.

φοινοπαστος, sprinkled with red.

♂ ♀. 24-29 mm. Head grey. Palpi fuscous. Antennæ fuscous; ciliations in ♂ 4. Thorax grey mixed with ferruginous-red. Abdomen grey partly mixed with ferruginous on dorsum. Legs fuscous. Forewings moderate, not dilated, costa gently arched, apex round-pointed, termen

nearly straight, oblique; grey densely irrorated, except on margins, with ferruginous-red, which sometimes tends to form longitudinal streaks; a suffused whitish discal spot at 3/5; cilia grey with a few ferruginous scales. Hindwings and cilia grey.

Mount Wellington (4,000 ft.), and Lake Fenton (3,500 ft.) in January; six specimens.

Philobota rasilis, n.sp.

rasilis, smooth.

♂. 24 mm. Head ochreous-whitish. Palpi pale fuscous; apex and posterior surface of second joint ochreous-whitish. Antennæ grey; ciliations in ♂ 1½. Thorax whitish-grey. Abdomen and legs grey. Forewings moderate, scarcely dilated, costa slightly arched, apex pointed, termen slightly sinuate, oblique; whitish-grey; discal dots fuscous, the two basal minute or obsolete, first discal before 1/3, second before 2/3, plical shortly before first discal; cilia whitish-grey. Hindwings and cilia grey.

Hobart in January; two specimens (W. B. Barnard).

Philobota lissopolia, n.sp.

λισσοπολιος, smooth grey.

♂ ♀. 22-24 mm. Head, palpi, thorax, and abdomen pale grey. Antennæ pale grey; ciliations in ♂ 2. Legs grey; posterior pair whitish. Forewings moderate, dilated posteriorly, costa rather strongly arched, apex rounded-rectangular, termen rounded, slightly oblique; pale grey; markings fuscous; a discal dot at 1/3, a second before 2/3, plical beyond first discal; a submarginal series of dots from beneath 2/3 costa to tornus; cilia pale grey. Hindwings and cilia whitish-grey.

Not unlike *P. ethnitis*, Meyr., but the antennal ciliations are much shorter.

Rosebery in February; three specimens.

Philobota placochorda, n.sp.

πλακοχορδος, broad-striped.

♂. 26-30 mm. Head white. Palpi white; second joint except apex fuscous on external surface. Antennæ grey, towards base whitish; ciliations of ♂ 4. Thorax dark fuscous. Abdomen dark grey. Legs fuscous; posterior pair whitish-grey. Forewings elongate, not dilated, costa straight, slightly arched towards base and apex, apex pointed, termen nearly straight, oblique; dark fuscous; a very broad white streak from base to 4/5 costa, giving rise to two processes near its distal end reaching tornus, where they some-

times fuse; a dark fuscous discal spot at 2/5, and another at 3/5; a terminal series of white dots; cilia fuscous. Hindwings and cilia dark grey.

Nearest *P. anachorda*, Meyr.

Bothwell in February and March; two specimens (W. B. Barnard).

Philobota hyphanta, n.sp.

ὑφαντος, interwoven.

♂. 21 mm. Head white. Palpi whitish; external surface of second joint except apex dark fuscous. Antennæ dark fuscous; ciliations in ♂ 5. Thorax white mixed with dark fuscous. Abdomen fuscous. Legs fuscous; tarsi white-ringed; posterior pair except tarsi mostly whitish. Forewings not dilated, costa gently arched, apex pointed, termen nearly straight, strongly oblique; white, but mostly overlaid with dark fuscous markings; an elongate basal costal spot; a similar spot on 1/3 costa, more or less confluent with a discal spot at 1/3, and this with a large dorsal suffusion extending on dorsum from near base to near tornus, and including an irregular white area above dorsum; two confluent discal spots at 2/3, more or less connected with a large apical blotch extending from 3/5 costa to tornus; cilia dark fuscous, apices partly whitish. Hindwings and cilia dark grey.

Nearest *P. niphias*, Meyr.

Lake Fenton (3,500 ft.) in January; one specimen.

Philobota poliocneca, n.sp.

πολιοκνηκος, yellowish grey.

♀. 22 mm. Head whitish. Palpi grey; terminal joint fuscous, towards base whitish. Antennæ fuscous. Thorax, abdomen, and legs grey. Forewings moderate, not dilated, costa gently arched, apex round-pointed, termen obliquely rounded; grey generally suffused with pale ochreous; cilia grey. Hindwings and cilia pale grey.

Cradle Mountain (3,000 ft.) in January; one specimen (W. B. Barnard).

Philobota micranepsia, n.sp.

μικρανεψιος, a small cousin.

♂. 14-20 mm. Head and thorax fuscous. Palpi fuscous; apex of second joint narrowly whitish. Antennæ fuscous; ciliations in ♂ 2½. Abdomen and legs fuscous. Forewings somewhat dilated posteriorly, costa gently arched, apex acute, termen very obliquely rounded; brownish-fuscous; discal dots minute, dark-fuscous, first at 2/5, second

at 3/5, plical beneath first discal; sometimes indications of a dark-fuscous, subterminal line; cilia brownish-fuscous. Hindwings and cilia dark grey.

Lake Fenton (3,500 ft.) and Cradle Mountain (3,000 ft.) in January; nine specimens.

Eochrois cirrhophara, n.sp.

κιρροφαρος, in yellowish robe.

♂ ♀. 18-20 mm. Head, palpi, and thorax ochreous tinged with grey. Antennæ white finely annulated with blackish; ciliations in ♂ 2. Abdomen grey. Legs fuscous; posterior pair whitish-ochreous. Forewings elongate-triangular, costa gently arched, apex pointed, termen sinuate, oblique; ochreous tinged with grey; in ♂ without markings; in ♀ with faint rosy discal dots, first at 1/3, second at 2/3, plical beneath first discal, and a faint rosy elongate subterminal suffused spot from tornus; cilia grey, apices whitish. Hindwings with termen slightly sinuate; grey; cilia grey.

Rosebery, Zeehan, and Strahan in February; ten ♂ and one ♀ specimens.

Thudaca innubila, n.sp.

innubilus, unclouded.

♂. 20-22 mm. Head and thorax grey-whitish. Palpi long, second joint three times length of face, terminal joint 1/3; whitish. Antennæ whitish. Abdomen and legs whitish. Forewings narrow-oval, costa moderately arched, apex acute, termen very obliquely rounded; white; cilia white. Hindwings and cilia white.

Rosebery, Zeehan, and Strahan in February; thirteen specimens.

Cryptolechia lutea, n.sp.

luteus, yellow.

♂. 21-22 mm. Head orange-yellow. Palpi yellowish; second joint with a broad dark fuscous ring before apex. Antennæ grey-whitish, towards base ringed with blackish. Thorax orange yellow with a fuscous dot on each shoulder. Abdomen grey-whitish; apical segments and tuft ochreous-yellow. Legs whitish-ochreous; anterior tibiæ, anterior and middle tarsi with dark-fuscous rings. Forewings oval, costa strongly arched towards base, gently towards apex, apex rounded, termen obliquely rounded; orange-yellow; a short blackish costal streak from base; a blackish dot on costa at middle, and another in disc at 3/5; cilia ochreous-yellow. Hindwings and cilia whitish-ochreous.

Rosebery in February; eight specimens.

Cryptolechia argillea, n.sp.

ἀργιλλεος, clay-coloured.

♂. 20 mm. Head pale brown. Palpi dark fuscous; apex and base of second joint whitish. Antennæ grey, towards base ringed with blackish. Thorax brownish with a fuscous spot on each shoulder. Abdomen pale grey; tuft whitish-ochreous. Legs ochreous-whitish; anterior pair mostly dark-fuscous; anterior and middle tarsi with dark fuscous rings. Forewings oval, costa strongly arched towards base, gently towards apex, apex rounded, termen obliquely rounded; pale brown; a costal streak to ¼, and a costal dot at 3/5, fuscous; cilia pale brown. Hindwings and cilia pale grey.

Closely allied to the preceding, of which it might possibly be an aberration, but differing much in colour, and without discal dot.

Rosebery in February; one specimen.

Cryptolechia illepida, n.sp.

illepidus, inelegant.

♂. 18-20 mm. Head, palpi, antennæ, and thorax fuscous. Abdomen grey. Legs fuscous; tarsal rings and most of posterior pair whitish. Forewings narrow, slightly dilated posteriorly, costa gently arched, apex rounded, termen very obliquely rounded; fuscous; discal dots slightly darker, first at 1/3, second slightly beyond middle, plical before first discal; cilia fuscous, apices paler. Hindwings and cilia grey.

Russell Falls in January; two specimens.

Fam. HELIODINIDÆ.

Gen. LEUROSCELIS, nov.

λευροσκελις, smooth-legged.

Tongue present. Labial palpi moderately long, ascending, curved, smooth, acute; terminal joint as long as second. Maxillary palpi obsolete. Posterior tibiæ smooth with short terminal whorl of scales; posterior tarsi with very short terminal whorls on each joint. Forewings with 6 and 7 long-stalked, 7 to costa, 8 absent. Hindwings with all veins present and separate.

Leuroscelis coracopis, n.sp.

κορακωπις, black as a crow.

♀. 12 mm. Head and palpi blackish. Antennæ blackish; from 3/5 to 4/5 white. Thorax blackish; anterior

margin grey. Abdomen blackish; under-surface whitish. Legs blackish; femora whitish. Forewings narrow, costa straight, apex obtusely pointed; blackish; an obscure suffused grey-whitish spot on tornus; cilia blackish; on extreme apex grey-whitish. Hindwings lanceolate; dark-fuscous; cilia 3, dark-fuscous.

Moina (2,000 ft.), Cradle Mountain Road, in January; one specimen.

Fam. GLYPHIPTERYGIDÆ.

Gen. CYLICOPHORA, nov.

κυλικοφορος, cup-bearing.

Head with appressed scales. Tongue and maxillary palpi obsolete. Labial palpi rather short, porrect or somewhat ascending, not reaching antennæ; second joint thickened with rough scales anteriorly; terminal joint very short, acute. Antennæ with basal joint thickened in front by a strong expansion of scales and flattened beneath to form an eyecap; in ♂ with extremely long pectinations, longest about middle (10), much shorter before apex. Thorax not crested. Posterior tibiæ smooth-scaled. Forewings with all veins present, 2 from near angle, 7 separate, to termen, 8 and 9 stalked, 8 to apex, 11 from 2/3. Hindwings with all veins present, 2 from 4/5, 3 and 4 approximated at origin, 5, 6, 7 separate, parallel.

A peculiar genus with extraordinary antennal structure.

Cylicophora collina, n.sp.

collinus, of the hills.

♂. 14-16 mm. Head ochreous-whitish. Palpi fuscous. Antennæ whitish; pectinations fuscous. Thorax and abdomen fuscous. Legs fuscous; posterior pair grey; terminal joints of middle and posterior tarsi whitish. Forewings moderate, not dilated, costa moderately arched, apex round-pointed, termen obliquely rounded; fuscous with variably developed white transverse strigulæ; these combine to form two fasciæ; first antemedian, moderately broad, outwardly curved, its outer edge angled above middle; second illdefined broad on costa from middle to ¾, narrowing to a point at tornus; some irregular ochreous irroration; two dark fuscous discal dots in fasciæ, first beyond 1/3, second at 2/3; some ochreous-whitish terminal dots; cilia fuscous. Hindwings and cilia fuscous.

Cradle Mountain (3,000 ft.) in January; one specimen (W. B. Barnard).

Glyphipteryx haplographa, n.sp.

ἁπλογραφος, simply marked.

♂. 10 mm. Head and thorax dark-fuscous; face whitish. Palpi slightly rough-scaled beneath; whitish without dark rings, apex fuscous. Antennæ fuscous. Abdomen dark-fuscous; extreme base and apex narrowly whitish. Legs dark-fuscous; whitish tibial rings very slender. Forewings narrow, costa slightly sinuate, apex rounded, termen nearly straight, oblique; 7 and 8 separate; blackish; two slender white transverse fasciæ, first at 1/3, second at 2/3; a white costal dot before apex, partly in cilia; cilia blackish, apical half white except on apex and above tornus, wholly white on tornal end of second fascia. Hindwings narrow-lanceolate; grey; cilia 3, grey.

Not near any other species so far as I know.

Zeehan in February; one specimen (G. H. Hardy).

Glyphipteryx leucargyra, n.sp.

λευκαργυρος, silvery-white.

♂ ♀. 16-18 mm. Head whitish; face grey. Palpi with very long rough hairs beneath; white with four fuscous rings. Antennæ fuscous. Thorax whitish with grey sides. Abdomen grey with whitish rings on apices of segments. Legs fuscous; posterior tibiæ and all tarsi ringed with white. Forewings moderate, costa gently arched, apex rounded, termen nearly straight oblique; 7 and 8 separate; pale ochreous-grey; markings shining silvery-white; two short, broad, very oblique dorsal streaks; first from base to fold; second from middle just crossing fold; seven fine costal streaks partly edged with dark-fuscous; first from ¼, strongly outwardly-oblique, reaching about half across wing; second short; third from middle of costa to tornus, interrupted in mid-disc, before the interruption is a white spot; fourth sinuate reaching 2/3 across disc; fifth and sixth very short; seventh reaching to terminal incision; a streak from tornus towards but not reaching sixth costal streak; often some fuscous suffusion in posterior part of disc, but no defined markings; cilia with basal half ochreous-grey, apical half white, divided by a blackish line, which is interrupted above midtermen, a dark-fuscous apical hook. Hindwings broadly lanceolate; grey; cilia ¾, grey.

Cradle Mountain (3,000 ft.) in January, Rosebery in February, Zeehan in January; five specimens (W. B. Barnard and G. H. Hardy).

Glyphipteryx gypsonota, n.sp.

γυψονωτος, with chalk-white back.

♂. 16-18 mm. Head whitish. Palpi with very long rough hairs beneath; white with four blackish rings. Antennæ fuscous. Thorax white; shoulder-flaps ochreous-grey. Abdomen grey; apex of tuft whitish. Legs fuscous; tarsi with white rings; anterior coxæ and posterior tibiæ except a subapical band white. Forewings moderate, posteriorly dilated, costa gently arched, apex rounded, termen nearly straight, oblique; 7 and 8 separate; ochreous-grey with a suffused white streak along dorsum; markings silvery-white narrow streaks partly edged with blackish scales; seven costal streaks; first from ¼ costa obliquely outwards, becoming longitudinal in middle of disc, then bent at a rounded right angle, ending on dorsum before tornus; second short; third and fourth reaching half across disc; third nearly touching first at angle; fifth and sixth short; seventh ending in terminal incision; an outwardly oblique sinuate streak from tornus towards, but not reaching, sixth costal streak; cilia with basal half ochreous-grey, apical half white, divided by a blackish line above middle of termen, a blackish apical hook. Hindwings ovate-lanceolate; grey; cilia 2/3, grey.

Rosebery in February; six specimens (W. B. Barnard).

Fam. HYPONOMEUTIDÆ.

Gen. PAURONEURA, nov.

παυρονευρος, with few veins.

Head with side tufts smooth, but with rough projecting hairs anteriorly between antennæ; face shortly rough-scaled. Tongue present but weak. Maxillary palpi obsolete. Labial palpi moderately long, drooping, smooth. Antennæ nearly as long as forewings; basal joint much enlarged with rough scales, which form a dense pecten beneath; in ♂ simple. Posterior tibiæ with long hairs, smoothly appressed on dorsum, but forming a long spreading apical tuft extending half the length of tarsi; beneath with long spreading hairs. Forewings with 4 absent, 7 and 8 stalked, 7 to costa, 11 from before middle. Hindwings ovate-lanceolate, cell ½, costal margin weak or obsolete, 3, 4, and 5 absent, 6 and 7 connate.

Very peculiar in the much reduced venation of hindwings, specialised also in the structure of the head and bases of antennæ. I find it difficult to place this genus, but think it goes best here. It is possibly remotely allied to *Thereutis*, Meyr.

Pauroneura acrospila, n.sp.

ἀκροσπιλος, with apical spot.

♂. 18 mm. Head, antennæ, thorax, abdomen, and legs dark-fuscous. Palpi whitish. Forewings broadly lanceolate; dark-fuscous; a small white apical spot; cilia fuscous. Hindwings ovate-lanceolate; fuscous; cilia 1, fuscous.

Lake Fenton (3,500 ft.), National Park, in January; one specimen.

Charicrita othonina, n.sp.

ὀθονινος, made of linen.

♂. 14 mm. Head, palpi, and thorax ochreous-whitish. Antennæ grey-whitish. Abdomen whitish. Legs grey; posterior pair whitish. Forewings rather narrow, not dilated, costa gently arched, apex pointed, termen sinuate, strongly oblique; ochreous-whitish; two or three minute blackish dots on basal fourth of costa, and four or five on dorsum; a blackish dot in disc at 2/3 beneath middle; cilia ochreous-whitish. Hindwings ovate-lanceolate; whitish; cilia whitish.

Strahan in February; one specimen.

Fam. GRACILARIADÆ.

Cyphostica zophonota, n.sp.

ζοφονωτος, dusky-backed.

♂. 20 mm. Head and thorax fuscous-brown. Palpi anteriorly dark-fuscous, posteriorly brownish becoming whitish towards base. Antennæ fuscous. Abdomen fuscous. Legs fuscous; middle tibiæ thickened with median and terminal tufts of scales. Forewings narrow, elongate; ochreous-white; a narrow fuscous-brown costal streak to ½; a broad dorsal streak extending to fold, gradually narrowing to tornus, fuscous-brown; terminal part of disc suffused with brown, in it an outwardly-oblique blackish streak containing a few white scales; cilia fuscous-brown, on tornus and dorsum grey. Hindwings lanceolate; grey; cilia 3, grey.

Cradle Mountain (3,000 ft.) in January; one specimen. This species together with *C. ostracodes* was taken by beating *Fagus cunninghami* into an umbrella on a cold rainy day.

Fam. AMPHITHERIDÆ.

Gen. CHALCOTEUCHES, nov.

χαλκοτευχης, in brazen armour.

Head densely rough-haired; face smooth. Tongue present. Labial palpi long, slender, smooth-scaled ascending,

recurved; terminal joint as long as second, acute. Maxillary palpi obsolete. Antennæ longer than forewings (1¼); in ♂ simple. Eyes normal. Posterior tibiæ smooth above, beneath shortly rough-scaled between spurs. Forewings with 2 from shortly before angle, 7 and 8 stalked, 7 to costa, anal veins forming a long basal U loop. Hindwings much broader than forewings, termen sinuate; 2 from 4/5, 3 and 4 stalked, 5, 6, 7 widely separate, equidistant parallel.

Chalcoteuches phlogera, n.sp.

φλογερος, blazing.

♂. 12-14 mm. Head pale-brown; face ochreous-silvery. Palpi fuscous; internal surface whitish. Antennæ fuscous. Thorax shining purple-coppery or green-coppery. Abdomen and legs fuscous. Forewings broadly lanceolate; brilliantly metallic coppery, green, purple, and red, variously mixed; cilia fuscous, apices whitish beneath apex of wing. Hindwings about twice as broad as forewings, termen slightly sinuate; fuscous; cilia fuscous.

♀. 14-16 mm. Similar; but forewings with four white spots; two median at 1/3 and 2/3, the latter transversely elongate; a subdorsal spot at ¼, sometimes extending to margin, and a second dorsal spot at ¾.

Cradle Mountain (3,000 ft.) in January; locally common, beaten from *Fagus*.

Fam. TINEIDÆ.

Ctenocompa baliodes, Meyr.

Meyrick received his type from Mr. G. Barnard and gave Duaringa, Queensland, as its locality. This is I think almost certainly an error. The late Mr. Barnard probably took this species from Tasmania; indeed, it is known to me only from this island, but Lower records an example from Melbourne.

Narycia retinochra.

Xysmatodoma retinochra, Low., Trans. Roy. Soc. S.A., 1903, p. 71.

♂. 15-17 mm. Head white. Palpi and antennæ pale-fuscous. Thorax fuscous with a white posterior spot. Abdomen grey. Legs fuscous; posterior pair fuscous-whitish. Forewings suboval, costa moderately arched, apex round-pointed, termen obliquely rounded; 7 and 8 stalked; whitish or ochreous-whitish with fuscous strigulæ and markings; a small basal spot; a spot on dorsum at ¼ formed of several conjoint strigulæ; a fascia from 1/3 costa to mid-dorsum,

sometimes irregularly constricted in disc; a second fascia from 2/3 costa to tornus, sometimes bent in middle; a large apical spot, sometimes confluent with second fascia; a fine terminal line; cilia white, sometimes barred with fuscous above tornus. Hindwings and cilia grey.

Closely similar to *N. hamalitha*, Meyr., but may be distinguished by the neuration of forewings and white spot on thorax. Lower's description is misleading, but I have seen specimens named by him in the Littler Collection.

Bothwell in March, Rosebery and Strahan in February; four specimens. Also from Launceston (F. M. Littler).

Narycia toxoteuches, n.sp.

τοξοτευχης, armed with a bow.

♂. 24-26 mm. Head and palpi whitish-grey. Antennæ grey; ciliations in ♂ 1. Thorax fuscous. Abdomen grey. Legs fuscous; posterior pair whitish. Forewings elongate-oval, costa gently arched, apex round-pointed, termen very obliquely rounded; 7 and 8 stalked; grey-whitish with numerous fine transverse fuscous strigulæ; a rather narrow outwardly curved fuscous fascia from 1/3 costa to 2/5 dorsum, somewhat dilated above dorsum; some of the strigulæ tend to form irregular transverse lines; a fuscous line shortly before termen, submarginal; cilia grey-whitish. Hindwings pale-grey, almost translucent; cilia pale-grey.

Cradle Mountain (3,000 ft.) in January (W. B. Barnard); two specimens.

Narycia euctena, n.sp.

εὐκτενος, pectinate.

♂. 22 mm. Head, palpi, thorax, abdomen, and legs fuscous. Antennæ fuscous; in ♂ bipectinate, pectinations 2½, gradually shortening towards base and apex, apical 1/5 simple. Forewings (badly rubbed) triangular, costa slightly arched, apex rounded, termen very obliquely rounded; 7 and 8 coincident; fuscous; three whitish costal spots at ¼, middle, and before ¾; cilia fuscous. Hindwings over 1; fuscous; cilia fuscous.

Being in poor condition the markings on forewings may be inadequately described, but the species differs from all others of the genus in its antennal structure. Type in Coll. Lyell.

Hobart; one specimen.

Mœrarchis lapidea, n.sp.

lapideus, made of stone.

♂. 25 mm. Head and palpi ochreous-grey-whitish. Antennæ grey; in ♂ dentate, ciliations ½. Thorax grey-

whitish with a fuscous spot on each shoulder. Abdomen grey. Legs grey; tarsi with obscure whitish rings. Forewings elongate, not dilated, costa gently arched, more strongly towards apex, apex pointed, termen nearly straight, oblique; grey-whitish; markings fuscous; an outwardly oblique bar from 1/3 costa half across disc; a median subdorsal spot beneath this; four inwardly oblique long striæ from costa beneath 2/3 and apex; two dots on apical half of dorsum, and another on tornus; an interrupted terminal line; cilia ochreous-whitish. Hindwings grey; cilia whitish, bases pale grey.

Strahan in February; one specimen (W. B. Barnard).

Tinea corynephora, n.sp.

κορυνηφορος, club-bearing.

♂. 16 mm. Head whitish. Palpi fuscous; apex whitish. Antennæ fuscous. Thorax whitish; shoulder-flaps fuscous. Abdomen grey. Legs fuscous; tarsi with ochreous-whitish rings. Forewings narrow triangular-oval, costa straight to middle, thence gently arched, apex pointed, termen very oblique; fuscous; a rather broad, irregular-edged, whitish streak from base along fold, broadening at tornus into a large apical blotch which extends to termen and costa, but contains a few fuscous scales; cilia fuscous-whitish, fuscous on middle of termen, on apex dark-fuscous, on termen with a basal series of dark-fuscous bars. Hindwings ovate-lanceolate; grey; cilia 2/3, grey.

Mount Wellington (2,500 ft.) in January; one specimen.

Fam. COSSIDÆ.

Gen. IDIOSES, nov.

ἰδιοσης, a peculiar moth.

Head rough-scaled. Tongue and maxillary palpi absent. Labial palpi short, porrect, diverging, smooth-scaled. Antennæ of ♂ bipectinated to apex. Thorax smooth. Abdomen with long hairs on dorsum. Posterior tibiæ with long hairs on dorsum. Forewings with forked median vein in cell, stalk and lower branch strongly developed, upper branch weak; chorda and areole absent; all veins present, 2 from angle, 3 and 4 stalked, arising remote from 2, 7, 8, 9 stalked from upper angle, 7 only shortly, 8 to just below apex, 10 and 11 separate, 11 from slightly before angle. Hindwings with a single median vein in cell, cell over ½; 2, 3, 4, 5 separate, 5 from near lower angle, 6 and 7 connate from upper angle, 12 separate.

Although of small size the type species has all the *facies* of a Cossid, and the absence of a tongue together with the strongly developed median vein of forewing are sufficient to refer it to this family. The complete absence of an areole gives it a deceptive resemblance to the *Tineidæ*. Probably the chorda has disappeared by coalescence as in the Neotropical genus *Acyttara*.

Idioses littleri, n.sp.

♂. 27 mm. Head fuscous, posteriorly grey. Palpi fuscous. Antennæ fuscous; pectinations in ♂ 5. Thorax grey. Abdomen whitish-ochreous. Legs fuscous; tibiæ and tarsi with whitish rings. Forewings oval-triangular, costa straight to near apex, apex rounded, termen rounded, moderately oblique; pale-grey with obscure whitish strigulations; an interrupted, transverse, dark-fuscous, sub-basal line, slightly outwardly curved; a series of pale fuscous small costal spots; two or three fuscous transverse strigulæ in disc before middle; a suffused whitish subapical blotch; apical area dark-grey, preceded by three dark-fuscous dots; cilia grey, darker towards apex, paler towards tornus. Hindwings with termen gently rounded; pale brownish-fuscous; cilia pale-grey.

Launceston; one specimen in the Littler Collection, South Australian Museum. I dedicate this interesting species to F. M. Littler, whose early death has been a great loss to entomology.

Fam. HEPIALIDÆ.

Hectomanes rufula, n.sp.

rufulus, reddish.

♂. 20-24 mm. Head and thorax reddish. Antennæ fuscous; pectinations in ♂ 3, gradually shortening to apex. Abdomen grey, reddish-tinged. Legs pale reddish. Forewings short, triangular, costa nearly straight, apex rounded, termen bowed, oblique; reddish; several transverse series of pale fuscous dots variably developed; cilia reddish. Hindwings with termen strongly bowed; fuscous, reddish-tinged; cilia reddish.

♀. 28-32 mm. Forewings narrow, elongate; pale reddish-grey; almost without markings. Hindwings grey. Antennal pectinations ½.

Differs from *H. simulans*, Wlk., in the forewings being shorter, broader, without silvery-white streaks, and with more rounded apices.

Hobart; one ♂ (Lea) Launceston one ♂ (Littler Coll.). Also from Gisborne, Victoria (Geo. Lyell), three ♂, 2♀.

Hectomanes pelagia, n.sp.

πελαγιος, by the sea.

♂. 40 mm. Head brown; face fuscous. Antennæ pale ochreous; pectinations in ♂ 6. Thorax, abdomen, and legs fuscous. Forewings semi-oval, costa straight, but sinuate before apex, apex rounded, termen and dorsum uniformly rounded; ochreous-brown becoming grey towards dorsum and termen with scanty whitish irroration between veins; cilia brownish. Hindwings and cilia grey.

♀. 45 mm. Head fuscous. Forewings uniformly grey. Antennal pectinations 1.

Much larger and more stoutly built than the other species of the genus.

Strahan in May; two specimens.

NOTES ON THE HABITS OF THE EXTINCT TASMANIAN RACE.

Number II.

By

William L. Crowther, D.S.O., M.B.

(Read 20th December, 1926.)

INTRODUCTION.

The Manuscript from which the following extracts were taken was found among the papers of the Rev. R. Knopwood after his death at Rokeby. It is not in his well-known large script (1). The writer describes the Natives as one who has evidently seen much of them at first hand, and his description of their habits agrees very closely with that of other observers. There is no clue to the writer's identity. The MS. is of four pages small quarto and written on both front and back. I am much indebted to J. W. Beattie, Esq., of Hobart, for permission to make these extracts, as the MS. is part of his unique collection of early Tasmanian material.

The interest of the description is twofold: describing as it does, firstly, the daily routine of the Natives, and, secondly, some of the measures proposed or actually tried, in order to control or conciliate them.

As regards the former, apart from the accounts of some of the early Navigators, we have little knowledge of their personal habits. Labillardière (2) and Ross (3) give perhaps the best eye witness account of their feeding.

Both are very much kinder in their observations than is the author of the present description.

In the second part there is much that is new to me. Governor Davey's Proclamation of 1817 is well known (4). This further series of pictorial proclamations was evidently in use in the early part of the administration of Governor Arthur, *circa* 1827-1831, as it was in the early thirties that the Natives were brought in by G. A. Robinson.

In reading these extracts one must bear in mind the extreme degree of partisanship then existing in Hobart Town and that the writer may be in some part ridiculing the Government. The early part of the MS. is, however, so closely in accord with what others have noted that in my belief we should accept it all as correct.

THE ABORIGINAL NATIVES OF VAN DIEMEN'S LAND.

The aboriginal natives of V.D.L., a race that is now nearly extinct (5), were among the lowest of those who possessed the form and language of man. Hunters without domicile except a few pieces of bark which they put together as a shelter from storm and rain and inhabited, if such a term may be used, for a few days during the continuation of bad weather.

Armed with a waddy (a short piece of heavy wood) and a spear fabricated from the long light and taper tea-tree, both of which they used with much missive dexterity. The females alone wearing a slight covering of Kangaroo skins over the shoulders and conveying in a net constructed of fibrous plants the few necessaries required in their simple and savage life, they passed onwards through the woods in pursuit of game through districts which however extensive were bounded by limits well defined and observed by the various tribes. Roused by the dawn like their nearly kindred denizens of the forest, they spread themselves abroad without losing contact and the means of reunion—destroyed the Kangaroo by the stone, the waddy, or the spear—ascended the most lofty Gum trees in search of the Opossum by means of notches cut in the bark, but more by the tenacity of limb peculiar to the climbing animal—extracted the grub from the decayed trunk—dug for the native yam or stripped the wattle of its gum, and about noon collected together, bearing their spoils, for their daily and only meal.

On that occasion the writer has witnessed a scene which the least fastidious must have beheld with disgust. A large fire was quickly made by throwing together the nearest logs of wood, with the addition of small pieces of bark, which were brought in by some of the hunters in a state of ignition apparently part of a continuous combustion which they might have conveyed from one pile to another for years. Then commences the operation of cookery, if such the rapid and barbarous proceeding might be considered. One of the savages, seizing a kangaroo, tosses it on the fire. In a few seconds the hair was singed off and in a few more the dressing complete. He then hastily smears it with half digested grass which he had extracted from the stomach, and darting his fingers with a force and rapidity that could only be compared to that of the talons of some large and powerful bird of prey into the fleshy protuberances near the tail, he

tore out large pieces which he thrust between his lips, thence quickly disappearing, to be immediately followed by others, without any seeming use of the teeth in the haste with which he satisfies his hunger. From each corner of his mouth descends a stream of blood that continues to ornament his visage until his ravenous craving for food was satiated, and after about half an hour employed by his companions devouring their prey in a similar manner the jaws of nearly all who were present appeared to approximate to a state of quiescence. While the brutal process of satisfying their hunger was in progress the boys watched with eager eyes for the seizure of the animals, which the favourite pieces being previously torn from them and gorged were thrown to the ground, and these they dispatched in a similar manner to their parents. The women were last in the order of consideration, as is universal in savage life, and their provision was rather scanty.

During the scene the Chief stood or perambulated aloof. His person was decorated with various ornaments (rude) composed chiefly of Bone and Berries of attractive and varied colours, and he satisfies his appetite in a manner infinitely more moderate than the inferiors of his tribe. His stature was above the usual standard. His features were remarkable for being comparatively free from the discordant proportions of the others of his tribe; they possessed a relatively intellectual expression, and altogether he presented a rather pleasing example of the aristocracy of nature. A short pause of listlessness and repose succeeded. Amorous attention to the females followed—parties separated and disappeared into the bush. Shrieks and yells of an indescribably wild and acute nature resounded from various quarters, indicating savage mirth and coy estrangement—these by degrees died away, and the close of evening united the tribe around the fire of the day, which in winter was renewed and in summer allowed to die away to its ashes. Such was the course of life of the aboriginal natives of V.D.L., varied only by those feuds with his companions and neighbours which seem inseparable from man in all his phases.

Dismay, self-abasement, and almost horror, were the emotions which it excited when for the first the beholder viewed their dusky figures naked and prostrate on the earth as they sank to a repose only interrupted by an occasional exclamation, more like the indefinite sounds of animal life than the articulate language of human beings, and reflected he must acknowledge them of his race and insomuch of his kindred. . . . . .

Attacks on the part of the natives, originally provoked by the aggression of the stock-keeper and aggravated by the daily encroachment and occupation of their grounds, had become too frequent to be disregarded. Lives had been lost and the deliberations of the Government at length assumed the shape and form of action. Several paintings on panels (a rather perishable material for their intended use) were executed, the size about 18 inches square. These were divided into compartments each of which represented a series of actions, admonitory to the natives, of the course intended by the Government to be pursued in future towards them. In one were represented natives attacking an unfortunate settler's house, reducing it to ashes and placing him in a rather unsettled situation. In a second a terrified wight, his wig departing in one direction and his hat in another, in the rapidity of his flight, was depicted pursued by them, but fortunately rescued by an ambuscade of soldiers, who by a well-directed discharge checked the advance of the enemy. A third; some of the delinquents in chains and the deadly grip of the constable. A fourth, the Court of Law at Hobart Town and their trial in progress, in which were introduced several striking likenesses of the gentlemen of the bar and one particularly admired, that of the Chief Justice Pedder. The subject of the sixth and final was an experiment on that abstruse subject the oscillation of the Pendulum. A native . . . . . etc. One represented a Settler receiving from a native a Kangaroo whom he rewarded by a piece of damper, the name by which bread baked in the ashes was then known. Again was seen the Governor in Regimentals surrounded by a number of aboriginals and patting on the head in the most condescending manner a Pickaninny or infant child. Next appears a minister of the church expounding to his dusky audience the truth of Christianity to the evident astonishment and delight and full perception of his hearers. Lastly, one of them appeared mounted on a horse and blowing a horn with a large leathern bag attached to his saddle, by which was indicated that in the event of their discontinuing hostilities and adopting a peaceful and orderly demeanour, official rank and station should be open to them, and that in time they might even aspire to the dignified and confidential employment of postmen.

These were affixed to trees in distant parts of the island, and the aid of even the infinitesimal calculus must have failed in estimating the chances of their having been observed, or, if observed, understood by those to whom they were directed.

Nothing more was heard of them, and the next step was of a more decisive and efficient nature.

A proclamation was issued by which the natives were incorporated with the other British subjects in the island, endowed with all their rights to the protection of the laws and also made liable to the penalties incurred by their violation. Many differences of opinion, however, existed as to the manner of apprising them of these beneficent intentions. At last it was suggested that the Bellman should be sent through the bush, provided with copies which he might distribute, reciting also their contents to audiences collected in the usual manner. That Functionary, however, was evidently startled at such an unexpected and indeed unreasonable proposition, and evinced much reluctance to undertake an adventure in the prosecution of which some danger might be incurred. He asserted with great appearance of truth that his official duties were limited to the most public street of Hobart Town.

A further expedient considered was to instruct a captured Aborigine in the general principals of Cons. Law and subsequently to dismiss him to his countrymen in order to impart to them the matter adverted to in the Proclamation. . . . . .

The manuscript, which is unsigned and incomplete, ceases at this point.

REFERENCES.

(1) The Rev. R. Knopwood was the official Chaplain to the expedition of Lieutenant-Governor Collins, who founded Hobart in 1804. After many years of service at the settlement he was appointed to Clarence Plains. He died at Rokeby in 1838.

(2) Labillardière. *Voyage in search of La Pérouse*, pp. 306-9.

(3) Ross. *Hobart Town Almanack*, 1830, pp. 100-1.

(4) A copy of this very rare Proclamation may be seen in the Tasmanian Museum.

(5) This sentence seems to show that the MS. was written at least 20-25 years after the events described, as about that time they were within measurable distance of extinction.

NOTE.

VOLCANIC ROCK AT ONE-TREE POINT, SANDY BAY.

Attention is called to a paper by W. Auroussean entitled *Analyses of Three Australian Rocks*, published in The Proceedings of the Linnean Society of N.S.W., 1926, Vol. 51, Part 4, No. 208, p. 614, in which the learned author describes this much disputed rock as a Nephelite-Basanite, and gives detailed analyses and other useful information.

A.N.L.

THE ROYAL SOCIETY OF TASMANIA

ABSTRACT OF PROCEEDINGS

1926.

8th March, 1926.

Annual Meeting.

The Annual Meeting was held on the 8th March at the Royal Society's Rooms, The Tasmanian Museum, Hobart, the President of the Society, His Excellency Sir James O'Grady, K.C.M.G., presiding.

The Annual Report was read and adopted. The following were elected members of the Council for 1926:—Mr. L. Rodway, Right Reverend Dr. R. S. Hay, Mr. W. H. Clemes, Dr. W. L. Crowther, Mr. W. H. Cummins, Major L. F. Giblin, Messrs. J. A. Johnson, A. N. Lewis, E. E. Unwin, and C. E. Lord (*ex officio*).

Paper.

The following paper was read:—

"The Isostatic Background of Tasmanian Physiography."
By A. N. Lewis, M.C., LL.M.

Illustrated Lecture.

Mr. Lewis delivered an illustrated lecture on "The Origin of our Tasmanian Mountains."

19th April, 1926.

The Monthly Meeting was held in the Society's Rooms on the 19th April, 1926, Mr. L. Rodway, Vice-President, presiding.

The following were elected as members of the Society:—Mrs. Annie Lindon, Reverend W. R. Barrett, Mr. Eric Waugh.

Reference was made to the monument erected on Lord Howe Island in memory of the late Allan R. McCulloch.

Lecture.

Mr. Frank Ellis delivered a lecture entitled "Some Aspects of Modern Science."

10th MAY, 1926.

The Monthly Meeting was held in the Society's Rooms on the 10th May, Mr. L. Rodway, Vice-President, presiding.

The following were elected as members of the Society:— Dr. C. N. Atkins, Professor E. J. G. Pitman, and Mr. B. N. Whittle.

Lecture.

Mr. Clive Lord delivered a lecture upon "The Fur Seals of Tasmania."

14th JUNE, 1926.

The Monthly Meeting was held at the Society's Rooms, The Tasmanian Museum, Mr. L. Rodway, Vice-President, presiding.

Papers.

The following papers were read:—

"The Oil Shales of Tasmania." By A. McIntosh Reid.

"On the Planting of the Dutch Flag in Tasmania in 1642." By Clive Lord.

12th JULY, 1926.

The Monthly Meeting was held at the Society's Rooms, The Tasmanian Museum, His Excellency Sir James O'Grady presiding.

The following were elected members of the Society:— Dr. D. O. Shiels, Mrs Rivers, Miss Rivers, Mrs. Robson.

Delegates were appointed to confer with the Launceston Branch *re* the formation of an Historical Section.

Lecturettes.

Several members of the Historical Section delivered a series of Lecturettes dealing with the period during which Sir William Denison was Governor of Tasmania.

9th AUGUST, 1926.

The Monthly Meeting was held at the Society's Rooms, The Tasmanian Museum, Mr. L. Rodway, Vice-President, presiding.

Mr. A. N. Lewis drew attention to the filming of "The Term of His Natural Life," and a resolution protesting against the filming was carried.

Lecture.

Mr. W. H. Cummins delivered a Lecture on "The Evolution of the Tasmanian Press."

11th OCTOBER, 1926.

The Monthly Meeting was held at the Society's Rooms, The Tasmanian Museum, on the 11th October, Mr. L. Rodway, Vice-President, presiding.

The following were elected as members of the Society:—Messrs. R. W. Giblin, D. C. MacKenzie, David Meredith, and F. E. Ward.

Papers.

The following papers were read:—

"Studies in Tasmanian Spiders." Part I. By V. V. Hickman, B.Sc.

"Studies in Tasmanian Cetacea." Part V. By H. H. Scott and Clive Lord.

"Two Hydromedusoid Records for Tasmania." By Professor T. T. Flynn. (Communicated by L. Rodway.)

Lecture.

Brigadier-General C. H. Jess delivered an address upon "Some Economic and Political considerations in relation to Defence, with particular reference to Tasmania."

8th NOVEMBER, 1926.

The Monthly Meeting was held at the Society's Rooms, The Tasmanian Museum, on Monday, 8th November, Mr. L. Rodway, Vice-President, presiding.

Lecturettes.

A discussion took place concerning the need for the conservation of the Tasmanian fauna.

The following Lecturettes were delivered:—

"The Sea Mammals." By Dr. W. L. Crowther.

"The Land Mammals." By C. E. Lord.

"The Birds." By M. S. R. Sharland.

20th DECEMBER, 1926.

A meeting was held at the Society's Rooms on Monday, 20th December, Mr. L. Rodway presiding.

Mr. Walter E. Taylor was elected Auditor in place of Mr. R. A. Black, who resigned owing to his departure from the State.

Papers.

The following papers were read:—

"Notes on, and Additions to, the Chiton Fauna of North-West Tasmania, together with a brief Review of the Genus *Stenochiton*." By Edwin Ashby, F.L.S.

"A Note on *Eucalyptus johnstoni*, Maiden." By L. Rodway, C.M.G.

"New and Little-known Tasmanian Lepidoptera." Part II. By A. Jefferis Turner, M.D., F.E.S.

"Notes on the Habits of the Extinct Tasmanian Race." By W. L. Crowther, D.S.O., M.A.

ANNUAL REPORT

1926.

THE ROYAL SOCIETY OF TASMANIA

Patron:

HIS MAJESTY THE KING.

President:

HIS EXCELLENCY SIR JAMES O'GRADY, K.C.M.G.

Vice-Presidents:

L. RODWAY, C.M.G.
A. H. CLARKE, M.R.C.S., L.R.C.P.

Council:
(Elected March, 1926)

L. RODWAY, C.M.G. (Chairman)
RT. REV. R. S. HAY, D.D.
W. H. CLEMES, B.A., B.Sc.
W. E. L. CROWTHER, D.S.O., M.B.
W. H. CUMMINS, A.I.A.C.
L. F. GIBLIN, D.S.O.
J. A. JOHNSON, M.A.
A. N. LEWIS, M.C., LL.M.
CLIVE LORD, F.L.S.
E. E. UNWIN, M.Sc.

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LIST OF MEMBERS

Honorary Members:

David, Sir T. W. Edgeworth, K.B.E., C.M.G., B.A., F.R.S., F.G.S., Emeritus Professor of Geology and Physical Geography in the University of Sydney. "Coringah," Sherbroke Road, Hornsby, N.S.W.

Mawson, Sir Douglas, D.Sc., B.E., F.R.S. Professor of Geology and Mineralogy, the University of Adelaide, South Australia.

Spencer, Sir William Baldwin, K.C.M.G., M.A., D.Sc., Litt.D., F.R.S. Melbourne.

Wood-Jones, Professor F., M.B., B.S., M.R.C.S., L.R.C.P., F.R.S. Professor of Anatomy, The University, Adelaide.

Corresponding Members:

Year of Election.

1901 Benham, W. B., M.A., D.Sc., F.R.S., F.Z.S. Professor of Biology, University of Otago, Dunedin, N.Z.

1892 Bragg, Sir W. H., M.A., F.R.S. Director of the Royal Institution, Albemarle Street, London.

1901 Chapman, Professor R. W., M.A., B.C.E. The University, Adelaide.

1875 Liversidge, Professor A. "Fieldhead," Coombe Warren, Kingston, Surrey, England.

1923 Pulleine, R., M.B. 163 North Terrace, Adelaide.

1902 Smith, R. G., D.Sc. Linnean Hall, Linnean Society of N.S.W., 16 College Street, Sydney.

1892 Thomson, Hon. G. M., M.L.C., F.L.S. 99 Eglinton Road, Dunedin, N.Z.

1901 Wall, A., Professor, M.A. Canterbury College, Christchurch, N.Z.

Life Members:

1918 Avery, J. 52 Southerland Road, Annadale, Melbourne.

1908 Baker, H. D. American Consular Service, Washington.

Year of Election.

1890 Foster, Lieutenant-Colonel Henry. "Merton Vale," Campbell Town.
1905 Grant, C. W. "High Peak," Huon Road.
1921 Harvey, D. H. "Manresa," Lower Sandy Bay.
1894 Mitchell, J. G. Parliament Street, Sandy Bay.
1896 Sprott, G., M.D. Town Hall, Hobart.

Members:

1921 Anderson, G. M., M.D., C.M. Clare Street, New Town.
1923 Agnew, Miss K. Augusta Road, New Town.
1925 Alexander, Miss H. Brown's River.
1921 Allen, D. V., B.Sc. Launceston Technical School, Launceston.
1924 Allen, F. A. 13 Franklin Street, West Hobart.
1925 Ashbolt, Sir Alfred. "Lenna," Battery Point.
1926 Atkins, Dr. C. N. Brown's River.
1921 Baker, H. S., LL.B. Messrs. Griffiths, Crisp, and Baker, Collins Street, Hobart.
1887 Barclay, D. 143 Hampden Road, Hobart.
1921 Barr, J. S., M.D. (Glasgow). Lower Sandy Bay.
1926 Barrett, Rev. W. R. Cressy, Tasmania.
1890 Beattie, J. W. 28 Jordan Hill Road.
1918 Bellamy, H., J.P., M.Am.Soc. C.E., M.I.Mech.E., F.R. San. I. Government Hydraulic Engineer, Adelaide.
1924 Bennett, Dr. H. W., L.D.S., D.D.S. Brisbane Street, Launceston.
1903 Bennett, W. H. Ashby, Ross.
1921 Bertouch, V. von. Wellington Square Practising School, Launceston.
1921 Bethune, Rev. J. W. Church Grammar School, Launceston.
1922 Biss, F. L. U.S.S. Co., Hobart.
1909 Blackman, A. E. Franklin.
1920 Blaikie, T. W. Practising School, Elizabeth Street, Hobart.
1928 Bowling, J. "Barrington," Tower Road, New Town.
1924 Booth, N. P. Messrs. Cadbury-Fry-Pascall Ltd., Claremont.
1925 Bowden, F. P. Jordan Hill Road.
1925 Bowerman, Captain. Marine Board, Hobart.
1923 Breaden, J. C. 12 Waverley Avenue, New Town.
1923 Brett, R. G. 53a Hill Street, Hobart.

Year of Election.

1917 Brettingham-Moore, E., M.B., Ch.M. Macquarie Street, Hobart.
1925 Brigden, Professor J. B., B.A. Tasmanian University, Hobart.
1911 Brooks, G. V. Director of Education, Hobart.
1922 Brownell, C. C. 117 Hampden Road, Battery Point.
1907 Brownell, F. L. "Berwyn," Mercer Street, New Town.
1924 Budge, E. A., B.Sc. 302 Argyle Street, Hobart.
1918 Burbury, Frederick. "Holly Park," Parattah.
1919 Burbury, Charles. "Brookside," Moonah.
1925 Butler, A. L. Lower Sandy Bay.
1923 Butler, Mrs. G. H. Augusta Road, New Town.
1909 Butler, W. F. D., B.A., M.Sc., LL.B. Bishop Street, New Town.
1924 Calver, C. W. 112 Brisbane Street, Launceston.
1920 Cane, F. B. 90 High Street, Sandy Bay.
1913 Chepmell, C. H. D. Clerk of the Legislative Council, Hobart.
1920 Clark, W. I., M.B. Macquarie Street, Hobart.
1896 Clarke, A. H., M.R.C.S., L.R.C.P. Domain Cottage, The Domain, Hobart.
1918 Clarke, T. W. H. "Quorn Hall," Campbell Town.
1910 Clemes, W. H., B.A., B.Sc. Clemes College, Hobart.
1922 Collier, J. D. A. The Librarian, Tasmanian Public Library, Hobart.
1925 Coogan, W. Lord Street, Sandy Bay, Hobart.
1924 Crabtree, R. W. The University, Hobart.
1924 Crisp, Cecil C. Lower Sandy Bay.
1911 Crowther, W. L., D.S.O., M.B. Macquarie Street, Hobart.
1917 Cullen, Rev. John. Macquarie Street, Hobart.
1918 Cummins, W. H., A.I.A.C. Manager, *The Mercury* Office, Hobart.
1925 Cunningham, Mrs. G. H. Augusta Road, New Town.
1925 Cunningham, G. H. 22 Augusta Road, New Town.
1922 Davidson, R. Temple Chambers, Macquarie Street, Hobart.
1924 Davies, G. B. 111 Patrick Street, Hobart.
1919 Davies, H. W. "Abermere," Mount Stuart.
1923 Davis, Alfred. Lord Street, Sandy Bay.
1923 Davis, Charles. Red Chapel Road, Lower Sandy Bay.
1908 Dechaineux, L. Technical College, Hobart.
1921 Dryden, M. S. 13 Hillside Crescent, Launceston.
1921 Eberhard, E. C. Charles Street, Launceton.

Year of Election.

1923 Edwards, Hon. F. B., M.L.C. Ulverstone.
1919 Elliott, E. A., M.B., Ch.M. Main Road, New Town.
1918 Ellis, F., M.A., B.E. Education Department, Hobart.
1921 Emmett, E. T. Railway Department, Hobart.
1921 Erwin, H. D. Hutchins School, Hobart.
1918 Evans, L. Secretary Agricultural Department, Hobart.
1921 Eyre, H. Manual Training School, Launceston.
1902 Finlay, W. A. 11 Secheron Road, Hobart.
1918 Fletcher, C. E. Education Department, Hobart.
1921 Forward, J. R. Mechanics' Institute, Launceston.
1921 Fox, Miss. Ladies' College, Launceston.
1918 Gatenby, R. L. Campbell Town.
1922 Giblin, A. V. King Street, Sandy Bay.
1925 Giblin, Miss Ella. 326 Macquarie Street, Hobart.
1908 Giblin, Major L. F., D.S.O., B.A. Davey Street, Hobart.
1926 Giblin, R. W. 77 Harrington Gardens, London, S.W. 7.
1924 Giblin, W. W., M.R.C.S., L.R.C.P. Macquarie Street, Hobart.
1923 Gorringe, J. A. Kempton, Tasmania.
1923 Gould, H. T. Liverpool Street, Hobart.
1924 Gray, H. 93 Macquarie Street, Hobart.
1923 Green, Dr. A. W. 30 Parliament Street, Sandy Bay.
1921 Hall, E. L. 38 Lyttleton Street, Launceston.
1922 Halligan, G. H., F.G.S. "Alameda," Challis Avenue, Turramurra, N.S.W.
1918 Harrap, Lieutenant-Colonel G. Launceston.
1924 Hawker, Mrs. J. F. 204 Davey Street, Hobart.
1919 Hay, Rt. Rev. R. S., D.D. Bishop of Tasmania, Bishopscourt, Hobart.
1924 Henry, Dr. C. C., M.B., F.R.C.S. St. John Street, Launceston.
1924 Heritage, F. W. Collins Street, Hobart
1921 Heritage, J. E. Frederick Street, Launceston.
1921 Heyward, F. J., F.R.V.I.A. 43 Lyttleton Street, Launceston.
1915 Hickman, V. V., B.Sc. Mulgrave Crescent, Launceston.
1914 Hitchcock, W. E. Moina, Tasmania.
1921 Hogg, W. Public Buildings, Launceston.
1918 Hogg, G. H., M.D., C.M. 37 Brisbane Street, Launceston.
1922 Hood, F. W. Customs House, Hobart.

Year of Election.

1921 Horne, G., V.D., M.D., M.S., Ch.B. Lister House, Collins Street, Melbourne.
1923 Hudspeth, W. H. "The Nook," Lower Sandy Bay.
1923 Hungerford, Mrs. "Red House," Fern Tree.
1923 Hungerford, Miss. "Red House," Fern Tree.
1909 Hutchison, H. R. 1 Barrack Street, Hobart.
1922 Huxley, G. H., M.A. Kent Avenue, West Hobart.
1913 Ife, G. W. R., LL.B. Mortimer Avenue, New Town.
1925 Irby, L. G. Conservator of Forests, Forestry Department, Hobart.
1898 Ireland, E. W. J., M.B., C.M. Launceston General Hospital, Launceston.
1919 Jackson, George A. 79 Collins Street, Hobart.
1906 Johnson, J. A., M.A. Training College, Hobart.
1922 Johnson, W. R. Clemes College, Hobart.
1922 Johnston, J. R. Murray Street, Hobart.
1921 Judd, W., M.A. College Street, Launceston.
1911 Keene, E. H. D., M.A. Burnie.
1922 Kemp, Andrew. Stoke Street, New Town.
1922 Kennedy, J. 96 Montpelier Road, Hobart.
1924 Kennedy, Mrs. J. 96 Montpelier Road, Hobart.
1910 Kermode, R. C. Mona Vale, Ross, Tasmania.
1918 Knight, C. E. L., B.Sc. Claremont.
1919 Knight, H. W. National Mutual Buildings, Hobart.
1913 Knight, J. C. E. Claremont.
1924 Legge, R. W. Cullenswood, Tasmania.
1919 Lewis, A. N., M.C., LL.M. "Werndee," Augusta road, New Town.
1887 Lewis, Sir N. E., K.C.M.G., M.A., B.C.L., LL.B. Augusta Road, New Town.
1912 Lindon, L. H. "The Lodge," Park Street, Hobart.
1926 Lindon, Mrs. "The Lodge," Park Street, Hobart.
1900 Lines, D. H. E., M.B., Ch.B. Archer Street, New Town.
1921 Listner, W. P., M.A., LL.B. Augusta Road, New Town.
1912 Lord, Clive E., F.L.S., Director of the Tasmanian Museum. "Cliveden," Sandy Bay.
1921 Lord, Raymond. "Handroyd," 6 Franklin Street, Hobart.
1924 Lord, Ronald. Derwentwater Avenue, Sandy Bay.
1922 Low, H. M. "The Gables," Pottery Road, New Town.
1893 McAulay, Professor A., M.A. The University, Hobart.
1923 McAulay, A. L., Ph.D. The University, Hobart.
1921 McClinton, Dr. R. 70 St. John Street, Launceston.

Year of Election.

1922 Macleod, Mrs. L. H. High Street, Sandy Bay.
1919 Mackay, A. D. 83 Patterson Street, Launceston.
1926 Mackenzie, D. C. Manager, Catamaran Coal Mine, Catamaran, Tasmania.
1918 Mansell, A. E. Arthur Street, West Hobart.
1924 Marsh, James. "Westella," Elizabeth Street, Hobart.
1918 Martin, Brigadier-General W. Launceston.
1921 Masters, A. H. A.M.P. Chambers, Launceston.
1926 Meredith, David. Electrolytic Zinc Co., Risdon.
1921 Meston, A. L. 115 Canning Street, Launceston.
1909 Millen, Senator J. Roxburgh, Newstead.
1907 Miller, L. S., M.B., Ch.B. 156 Macquarie Street, Hobart.
1921 Miller, R. M. State High School, Launceston.
1911 Montgomery, R. B. "Astor," Macquarie Street, Hobart.
1918 Murdoch, M.L.C., Honourable Thomas. 55 Montpelier Road, Hobart.
1926 Murray, L. C. 124 Warwick Street, Hobart.
1921 Muschamp, Rev. E. Holy Trinity Rectory, Launceston.
1925 Nettlefold, R. Macquarie Street, Hobart.
1924 Newall, A. P. Charles Street, Moonah.
1882 Nicholas, G. C. "Cawood," Ouse.
1918 Nicholls, Sir Herbert, Chief Justice of Tasmania. Pillinger Street, Sandy Bay.
1910 Nicholls, H. M. Department of Agriculture, Hobart.
1921 Nye, P. B., M.Sc., B.M.E. Geological Survey Office, Hobart.
1917 Oldham, N. New Town.
1921 Oldham, W. C. 39 George Street, Launceston.
1924 Oliver, H. Lindisfarne.
1922 Overell, Miss Lilian. Holebrook Place, Hobart.
1921 Padman, R. S. 56 St. John Street, Launceston.
1921 Patten, W. H. 59 Cameron Street, Launceston.
1923 Parker, Dr. G. M. Bellerive.
1922 Parker, H. T. "Montana," Bellerive.
1925 Pearse, D. C. "Garstang," Fisher's Avenue, Lower Sandy Bay.
1923 Pedder, A. Stoke Street, New Town.
1922 Perrin, Miss K. C/o Mrs. Harner, 12 York Street, Launceston.
1902 Piesse, E. L. "Merridale," Sackville Street, Kew, Melbourne.
1910 Pillinger, J. 4 Fitzroy Crescent, Hobart.
1926 Pitman, Professor E. J. G. Tasmanian University, Hobart.

Year of Election.

1918 Pitt, F. C. K. "Glen Dhu," The Ouse.

1925 Pratt, A. W. Courtney. "Athon," Mount Stuart Road, Hobart.

1925 Propsting, G. L. Earl Street, Sandy Bay.

1923 Purcell, G. A. Clemes College, Hobart.

1921 Reid, A. McIntosh. Geological Survey Office, Hobart.

1922 Reid, A. R. Curator, Beaumaris Zoo, Domain, Hobart.

1925 Reid, Miss M. L. The University, Hobart.

1921 Reid, W. D. Public Buildings, Launceston.

1921 Reynolds, John. Knocklofty Terrace, Hobart.

1926 Rivers, Miss. The Deanery, Hobart.

1926 Rivers, Mrs. Godfrey. Holebrook Place, Hobart.

1925 Robinson, F. G. 42 Regent Street, Sandy Bay.

1926 Robson, Mrs. "Elsinore," The Avenue, Elphin Road, Launceston.

1884 Rodway, L., C.M.G. 77 Federal Street, Hobart.

1923 Rogers, G. H. B. 204 Davey Street, Hobart.

1921 Rolph, W. R. *Examiner* and *Courier* Office, Launceston.

1913 Ross, Hector. Cambridge, Tasmania.

1922 Sargison, H. Elizabeth-street, Hobart.

1921 Savigny, J. A.M.P. Chambers, Launceston.

1921 Scott, H. H. Curator, Victoria Museum, Launceston.

1896 Scott, R. G., M.B., Ch.M. 172 Macquarie Street, Hobart.

1921 Sharland, M. S. R. *The Mercury* Office, Hobart.

1921 Shields, M.L.C., Honourable Tasman. 13 Patterson Street, Launceston.

1926 Shiels, Dr. 118 Main Road, Moonah.

1925 Shoobridge, K. Macquarie Plains, Tasmania.

1921 Shoobridge, Honourable L. M. "Sunnyside," New Town.

1925 Shoobridge, Rupert. "Fenton Forest," Glenora.

1923 Shoobridge, S. E. C/o Messrs. H. Jones and Co, Hobart.

1923 Simson, Mrs. L. 3 St. George's Square, Launceston.

1925 Smith, Colonel R. P. A.M.P. Society, Hobart.

1921 Smithies, F. 34 Patterson Street, Launceston.

1925 Stackhouse, C. K. R. 55 Patterson Street, Launceston.

Year of Election.

1924 Stephens, Crofton. Messrs. Clerk, Walker, Stops, and Stephens, Collins Street, Hobart.

1919 Stevenson, Miss F. "Leith House," New Town.

1920 Swindells, A. W. 2 Patrick Street, Hobart.

1918 Taylor, W. E. Elboden Street, Hobart.

1920 Taylour, W. H. Equitable Buildings, Collins Street, Melbourne.

1923 Thomas, J. F. Room 8, Wilga Chambers, 158 Phillip Street, Sydney.

1922 Thomas, Lieutenant-Colonel L. R., D.S.O. Registrar of the Tasmanian University, Hobart.

1921 Thomas, P. H. Agricultural Department, Hobart.

1922 Thompson, E. H. Lower Sandy Bay.

1918 Thorold, C. C. Hutchins School, Hobart.

1926 Turner, A. Jefferis, M.D., F.E.S. Wickham Terrace, Brisbane, Queensland.

1923 Unwin, E. E., M.Sc. Pendle Hill, Mortimer Avenue, New Town.

1925 Urquhart, M. L. Ashfield Street, Sandy Bay.

1918 Walch, P. B. C. King Street, Sandy Bay.

1925 Walker, Norman. The Hutchins School, Hobart.

1926 Ward, F. E. Director of Agriculture, Hobart.

1913 Wardman, John. Superintendent Botanical Gardens, Hobart.

1918 Waterhouse, G. W. Messrs. Ritchie and Parker, Alfred Green and Co., Launceston.

1922 Waterworth, E. N. Poet's Road, West Hobart.

1922 Watson, D. W. "Undine," Glenorchy.

1926 Waugh, Eric C., LL.B. High Street, Sandy Bay.

1922 Wayn, Miss A. L. Lower Sandy Bay.

1918 Weber, A. F. Lands Department.

1923 Webster, Hugh C. "Greystanes," Lower Sandy Bay.

1923 Wherrett, Miss A. Florence Street, Moonah.

1926 Whittle, B. N. Augusta Road, New Town.

1922 Winch, A. A. "Stornoway," Huon Road, Hobart.

1925 Winch, M. C/o Brownell Bros., Hobart.

1901 Wise, H. J. Lambert Avenue, Sandy Bay.

1924 Young, F. M., B.A. Montagu Street, New Town.

ANNUAL REPORT

1926.

The Council and Officers.

The Annual Meeting was held at the Society's Rooms, The Tasmanian Museum, Hobart, on the 8th March, 1926.

The following were elected members of the Council for 1926:—Messrs. W. H. Clemes, Dr. W. L. Crowther, W. H. Cummins, Major L. F. Giblin, Rt. Rev. Dr. R. S. Hay, Messrs. J. A. Johnson, A. N. Lewis, L. Rodway, E. E. Unwin, and C. E. Lord (*ex officio*).

During the year nine meetings of the Council were held, the attendance being as follows:—Mr. Rodway 9, Mr. Lord 9, Dr. Crowther 8, Mr. Lewis 8, Mr. Johnson 6, Mr. Clemes 5, Mr. Cummins 5, Major Giblin 5, and Mr. Unwin 5.

The Council at its first meeting made the following appointments:—

Chairman of Council.—Mr. L. Rodway, C.M.G.

Secretary.—Mr. Clive Lord.

Standing Committee.—Messrs. Rodway, Unwin, Lord, and Major Giblin.

Editor of Papers and Proceedings.—Mr. Clive Lord.

Hon. Treasurer.—Dr. W. L. Crowther.

Trustees of the Tasmanian Museum and Botanical Gardens:—Messrs. Rodway, Clemes, Lewis, Johnson, Unwin, and Dr. Crowther.

Meetings.

During the year nine ordinary meetings of the Society were held. Details of the meetings will be found in the Abstract of Proceedings.

Membership.

The Royal Society of Tasmania, in company with many other bodies, felt the effects of the period of financial depression from which Tasmania is just recovering. This is reflected in the membership, and a certain percentage of

subscriptions are still outstanding for the year, whilst certain members have allowed their membership to lapse. Whilst this is to be regretted, it is felt that the slight setback is of a temporary nature only, and that the improved conditions which may be anticipated with confidence during the coming year will be of considerable assistance to the work of the Society. The roll at the end of the year shows:— 4 Honorary Members, 8 Corresponding Members, 7 Life Members, and 230 Ordinary Members.

Historical.

In July, a conference was held in Launceston between members of the Northern Branch and representatives of the Council and the Historical Section with the object of advancing the study of early Tasmanian history and the collection of old documents. The Chairman (Mr. Rodway), Messrs. W. F. D. Butler, G. W. R. Ife, and C. E. Lord attended the meeting of the Northern Branch, and it is anticipated that benefit will arise from the conference.

At the general meeting of the Society held in August, the Council brought under notice of the members the proposal to film "The Term of His Natural Life," and, on the grounds that the novel is not true to history, and that its filming would be harmful to Tasmania, a resolution was carried protesting against the picture being made.

In last year's report reference was made to extracts from certain private diaries which had been made available to the Society, and the Council desires to place on record its appreciation of the action of Miss Hookey in permitting a copy to be made for the Society's Library of the original diary of the Reverend Robert Knopwood from January, 1805, to July, 1808. This section of the Knopwood diaries, which has not been made public previously, is of very considerable interest, and will prove a valued addition to the Society's Library.

Scientific Development of the Tasmanian Fisheries.

Since the very commencement of the official control of the fisheries of Tasmania, the Royal Society has been intimately connected with the movement. The greater part of the literature concerning the fishes of Tasmania is contained in the Papers and Proceedings of the Society, and the Society can claim to have done much owing to the investigations of its members and the publication of the results. In the past

due recognition has been given to the Society's work. Last year, however, the Government abolished the Fisheries Commissioners and placed the control of the sea and inland fisheries under separate boards. The work done by the Society and the important bearing which science has on the commercial prosperity of the sea fisheries was brought under notice of the Government, but unfortunately the past and present work of the Society failed to secure recognition, and the Sea Fisheries Board, as now composed, does not embrace a member of the Society, and the Society's official connection with the development of the Tasmanian fisheries has come to an end. This is a matter for regret, as in other countries increasing efforts are being made to encourage scientific institutions to become interested in and assist the development of the commercial activities of their country.

Science Congress.

The Council desires to bring under the notice of the members generally the fact that the Australasian Association for the Advancement of Science is holding a meeting in Hobart, commencing on the 16th January, 1928. The support of all members of the Society is desired in order that this important conference may prove a success and of distinct benefit to Tasmania in general.

Papers and Proceedings.

The financial position of the Society caused the Council to curtail the number of Papers printed in this year's volume. The position will require the earnest consideration of the incoming Council in order that all papers which are submitted and passed for printing next year may be published in full. The cost of a large proportion of this year's volume is not included in the Statement of Accounts.

Obituary.

It is with regret that the Society has to record the deaths of the following:—

Life Members:—

J. D. Foster, "Fairfield," Epping. (Elected 1905.)
Sir Henry Jones, Kt., Hobart. (Elected 1922.)

Members:—

Most Reverend Patrick Delany, Archbishop of Tasmania. (Elected 1903.)

H. E. R. Oldmeadow, "Roseneath," Austin's Ferry. (Elected 1919.)

BRANCH REPORT

NORTHERN BRANCH.

ANNUAL REPORT FOR 1926.

Our Annual Meeting was held on 21st May, when the following officers were re-elected members of the Council:—Hon. Tasman Shields, Messrs. H. H. Scott, J. E. Heritage, R. O. Miller, F. Smithies, J. R. Forward, F. J. Heyward, W. D. Reid, and R. S. Padman (Hon. Secretary and Treasurer).

At the conclusion of the formal business a most interesting Lecture was given by Mr. V. V. Hickman, B.Sc., on "Spiders and their Allies," introducing lantern slides of several new Tasmanian species recently discovered by the lecturer.

21st June.—Lecture by Mr. J. Moore-Robinson, F.R.G.S., on "Macquarie in Launceston, 1811 and 1821."

23rd July.—Visit from members Historical Section (Hobart) accompanied by Mr. L. Rodway, Senior Vice-President. At the conclusion of conference relating to establishment of Historical Section in connection with this Branch, a series of papers were read by Messrs. Dennis Butler (Chairman Historical Section), G. W. Ife, and C. Lord dealing with "Tasmania under Sir William Denison."

6th September.—Paper, "Evolution of the Sense of Sight," by Mr. R. S. Padman, followed by notes on the morphology of the Eye, illustrated with miscropic slides by Mr. H. H. Scott.

27th September.—Lecture by Mr. F. Ellis, M.A., B.E., on "The Ideas underlying Relativity."

Considerable interest in early Tasmanian History having been aroused by the several lectures given during the year, the local council have considered the formation of a local branch of the Historical Section which it is hoped to establish early in next session. By special arrangement with the parent Society permission has been granted, in the event of the local Section ceasing to function, that any local relics or documents collected by it may be deposited in the Museum or other public institution, so that they may be permanently retained in Launceston.

SECTION REPORTS

EDUCATIONAL AND PSYCHOLOGICAL SECTION.

Mr. E. E. Unwin, M.Sc., was elected President.

All meetings of the year were devoted to a discussion of the System of Examinations, under different aspects, the list of subjects and speakers being as follows:—

20th April.—"An Historical Survey of the Development of Examination Systems." By Mr. J. A. Johnson.

18th May.—"The Aim and Purpose of Examinations in Primary and Secondary Schools." By Messrs. H. T. Parkes and E. A. Budge.

22nd June.—"The Purpose and Aim of Examinations as applied to University and Technical Education." By Mr. Frank Ellis and Professor Dunbabin.

27th July.—"The Mind of the Examinee." By Mr. G. Huxley.

17th August.—"The Accrediting System." By Mr. C. E. Fletcher.

21st September.—"The Statistical Aspect of Examinations." By Major L. F. Giblin.

19th October.—A Summary of Papers and Discussions, by the President.

As a result of these meetings, the Section reached certain definite conclusions, set out hereunder, which are regarded as applying not only to boys but to girls in equal or even greater measure.

It is felt that, while some form of testing is not only essential but, in fact, inevitable, yet the present system of external public examinations does not meet the requirements of the situation, for the following reasons in particular:—

These examinations are so limited in their nature that they cannot give results that are an adequate return for the effort expended.

By reason of being the accepted test of learning they encourage false conclusions as to a pupil's requirements, and so often work injustice both to him and to his teacher.

They hamper general education by checking the development of individuality and self-reliance, while leaving little room for necessary experiment or for getting the full benefit of a teacher's personal influence.

They produce real unhappiness and often injure physical and mental health in a manner that, though subtle, is very far-reaching.

What is required is a method of testing that will not encourage a special preparation for it, and will best discover and recognise sustained industry.

To satisfy these requirements and to meet the foregoing objections, the Section recommends the adoption of the Accrediting System, by which approved schools, under proper safeguards and as an accepted alternative to public examinations, would supply certificates of proficiency to those pupils who have reached a required standard.

Some essentials of the System were laid down in Mr. Fletcher's paper which, by request of the Section, was published in the Educational Record (September issue). Such essentials were considered by Mr. Fletcher to be the following:—

(a) There must be an accrediting authority (which might be an association formed for this special purpose).

(b) Any examination must be of the school rather than of the individual.

(c) Considerable reliance must be placed upon the responsible teachers, who are recognised as the most capable judges of an individual pupil's attainments and ability.

(d) There must be inspection, for report to the accrediting authority.

(e) Internal examinations must be conducted, with questions and marked papers filed for future reference.

(f) The public must be guided to recognise the value and prestige of the system.

It is noteworthy that in 1921 the Section, as in this year, devoted all its sessions to a discussion of public examinations; and to the extent to which the aspects of the question considered are identical, seems to have arrived at precisely similar conclusions to those submitted in this report; which, in their turn, were formed without any reference whatever to those of 1921.

NORMAN WALKER,
Honorary Secretary.

HISTORICAL SECTION.

The chief activity of the Historical Section during the year was the collection of data relating to the period of Sir William Denison's term of Governorship, 1847-1854. Owing to the difficulty in arriving at a correct view of several questions of the day, namely Transportation and Responsible Government, the preparation of the Section's evening before the Society took longer than was the case in previous years. However, the lecturettes on the period were given before the July meeting of the Society. A general outline of the period was given by Mr. W. F. D. Butler. A biographical sketch of Sir William Denison was read by Mr. J. Reynolds, whilst his scientific and engineering attainments were described by Mr. Clive Lord. Mr. G. W. Ife dealt with Denison's administration, and Mr. A. W. Courtney-Pratt read a paper on the Transportation question.

At the invitation of the Northern Branch of the Society, Messrs. Butler, Ife, and Lord repeated their lecturettes in Launceston on 23rd July. Opportunity was taken by their visit to confer with the members of the Society in Launceston regarding co-operation in historical research in the future. The results of this conference were gratifying, and will have an important bearing on future work.

During the next year it is hoped to proceed further with the work of the Section, devoting particular attention to the early years of responsible government. It is also intended to make a definite move towards the establishment of a repository for many of the valuable historical relics now in danger of being lost to the State.

J. REYNOLDS,
Hon. Secretary.

ROYAL SOCIETY OF TASMANIA.

RECEIPTS AND EXPENDITURE, 1926. GENERAL FUND.

RECEIPTS.

	£ s. d.	£ s. d.
Balance brought forward		2 17 0
Subscriptions—		
Arrears	6 6 0	
Current	190 1 0	
Advance	5 5 0	
		201 12 0
Miscellaneous		5 10 6
Sale of Publications		1 0 0
Government Grant		100 0 0
Rent of Room		11 8 0
Refund from M.A.M. Fund		2 14 0
		£325 1 6

EXPENDITURE.

	£ s. d.	£ s. d.
Salaries		36 0 0
Papers and Proceedings—		
1925 (Part)	157 6 4	
1926 (Part)	24 17 8	
		182 4 0
Printing, Notices of Meetings, Etc.		28 8 5
Library		20 3 6
Insurances		6 4 3
Light & Fuel		2 14 0
Petty Cash & Postages		15 17 4
Northern Branch		9 9 0
Miscellaneous		21 2 3
Cr. Balance		2 18 9
		£325 1 6

Audited: correct.
WALTER E. TAYLOR, F.F.I.A.,
Hon. Auditor.

4/2/27.

W. L. CROWTHER,
Hon. Treasurer.

CLIVE E. LORD,
Secretary.

ROYAL SOCIETY OF TASMANIA.

MORTON ALLPORT MEMORIAL FUND, 1926.

RECEIPTS.

	£	s.	d.
Revenue, 1926	9	15	0
Loan from R.M.J. Fund	4	7	0
	£14	2	0

EXPENDITURE.

	£	s.	d.
Refund to General Fund	2	14	0
Mathews's "Birds of Australia" (Part)	11	8	0
	£14	2	0

Audited: correct.
WALTER E. TAYLOR, F.F.I.A.,
Hon. Auditor.

4/2/27.

W. L. CROWTHER,
Hon. Treasurer.
CLIVE E. LORD,
Secretary.

R. M. JOHNSTON MEMORIAL FUND, 1926.

RECEIPTS.

	£	s.	d.
Balance brought forward	25	11	10
Interest	14	12	0
	£40	3	10

PAYMENTS.

	£	s.	d.
Books purchased	17	13	0
Advance to M.A.M. Fund	4	7	0
Balance	18	3	10
	£40	3	10

Audited: correct.
WALTER E. TAYLOR, F.F.I.A.,
Hon. Auditor.

4/2/27.

W. L. CROWTHER,
Hon. Treasurer.
CLIVE E. LORD,
Secretary.

ROYAL SOCIETY OF TASMANIA.

NORTHERN BRANCH.

ANNUAL FINANCIAL STATEMENT FOR THE YEAR ENDING 31st DECEMBER, 1926.

	£	s.	d.
Balance on 31st December, 1925	21	13	11
Interest	0	16	2
Share of Subscriptions	9	9	0
	£31	19	1

	£	s.	d.
Advertising	4	0	0
Printing	2	12	0
Postages	0	10	0
Petty	0	15	0
Balance in Bank	24	2	1
	£31	19	1

Compiled from the books and accounts of the Royal Society of Tasmania (Northern Branch), and certified to be in accordance therewith.

J. E. HERITAGE,
Hon. Auditor.

R. STEWART PADMAN,
Hon. Sec. and Treasurer.

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R. M. JOHNSTON MEMORIAL.

The R. M. JOHNSTON MEMORIAL MEDAL.

List of Awards:

1923 Sir T. W. Edgeworth David, K.B.E., C.M.G., B.A., F.R.S., F.G.S.
1925 Professor F. Wood-Jones, M.B., B.S., M.R.C.S., L.R.C.P., D.Sc.

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